DOCUMENT RESUME

ED 250 912 FL 014 651

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TITLE Subjects Taught in French. Evaluation of the Second Language Learning (French) Programs in the Schools of the Ottawa and Carleton Boards of Education. Part I. Tenth Annual Report, December 1983.
INSTITUTION Ottawa Board of Education (Ontario). Research Centre.
SPONS AGENCY Ontario Dept. of Education, Toronto.
PUB DATE Dec 83
NOTE 113p.; For related document, see FL 014 652.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC05 Plus Postage.
DESCRIPTORS *Academic Achievement; *Bilingual Education; Comparative Analysis; Educational History; English; Foreign Countries; *French; Geography; Grade 9; Grade 10; *Language of Instruction; Mathematics; Program Evaluation; Public Schools; Secondary Education; Second Language Instruction
IDENTIFIERS *Ontario (Ottawa)

ABSTRACT

Groups taught in English and French in four Ottawa English-language schools were tested for achievement in mathematics and geography in grade 9 and history in grade 10, and the two groups' results were compared. In each subject area the group instructed in French had significantly higher mean scores on the available scholastic aptitude measures than the group instructed in English. Questionnaires administered to students and their teachers yielded opinions about the courses, especially relating to the language of instruction. After adjustments for ability, mathematics achievement was higher for the group instructed in French. Geography achievement was similar for the two groups, but students instructed in French and taking the test in both languages performed better on the English test, and a similar result was found in the grade 10 history test. Item analysis also showed some significant differences related to test language. No significant sex differences were found in mathematics, but ability-adjusted scores in geography and history were higher for boys. On the questionnaire, students taught in French reported bilingual exchanges as their major out-of-school opportunities to speak French. Bilingual students felt better prepared in mathematics than English-taught students but were also higher on aptitude and achievement scores. Students having experienced a change of language of instruction had only brief difficulties with the change. Students taught in French appreciated the exposure to it, but regreted lack of English subject-matter vocabulary. (MSE)

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ED250912

SUBJECTS TAUGHT IN FRENCH

Evaluation of the Second Language Learning (French) Programs in the Schools of the Ottawa and Carleton Boards of Education

PART I

Tenth Annual Report, December 1983

The Ottawa Board of Education
The Carleton Board of Education

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This Research was funded under contract by the Ministry of Education, Ontario

FL014651

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ABSTRACT

Introduction

Tests developed for use in grades 9 and 10 of the Carleton Board of Education were modified somewhat for administration in the spring of 1983 to students in classes being instructed in either English or French in four English-language schools of the Ottawa Board of Education. The subjects involved were mathematics and geography in grade 9 and history in grade 10, all at the advanced level.

In each subject matter area the group being instructed in French had significantly higher mean scores on the available scholastic aptitude measures than the group with instruction in English. The ability measure with the strongest relationship with scores on the test in question was therefore used as a covariate in each case, controlling statistically for differences in ability through an analysis of covariance (ANCOVA).

A set of questionnaires administered to students and teachers of the classes tested yielded subjective information or opinions about certain aspects of the courses, especially as they related to the language of instruction. The questionnaires were similar in content, with suitable variations according to whether the subject had been taught in English or French and whether they were addressed to students or teachers.

Test Results

After adjustment for ability, the mean scores on the mathematics tests in both languages for the group taking mathematics in French significantly surpassed those of the group instructed in English on the test given in English. The adjusted teacher-assigned class marks for the winter term were also significantly higher for the French instruction group.

There were no significant differences in the mean scores of the geography test taken in English between the results for the English and French instruction groups at the grade 9 level, after adjustment for differences in ability. However, the French instruction group had a significantly higher mean score on the test taken in English than on the similar but not identical test taken in French.

On the history test taken in English by grade 10 students, the difference between the groups instructed in different languages was not significant, after adjustment had been made for ability. However, as in the case of grade 9 geography, the mean score of the group instructed in French was significantly higher on the English version of the test than on the French version. In the case of class marks, the adjusted mean was significantly higher for the English instructional group than that for the group taking history in French.

An examination of item analysis data from the history test showed a number of items with significant differences between the analysis groups. In most cases one or both of the groups taking the test in English had better results than did the French instructional group on the test taken in French.

An analysis of the results for students who had taken both the English and the French versions of the test in each subject showed that the order of administration had made a difference in only one case. On the French version of the history test the mean score of the group which had taken it previously in English was significantly higher than that of the group which took it first in French.

No significant differences between boys and girls were found on the means, adjusted for differences in ability, on either version of the mathematics test or on any of the four ability measures available. On the geography and the history tests taken in English the total group of boys obtained significantly higher mean scores than the girls, after adjustment had been made for differences in ability.

Questionnaire Responses

When the students taking a subject in French were asked what opportunities to learn French outside of school they had experienced, more spoke of bilingual exchanges than anything else. From 25 to 40 per cent of each group had participated in at least one such exchange.

The bilingual program groups taking mathematics in either English or French appeared to feel better prepared to continue in that subject than did the regular program group taking it in English. However, there were also significant differences between these groups in both numerical aptitude and fall mathematics achievement scores. In geography and history, on the other hand, the differences between the analysis groups for the two languages were not significant with respect to their perceptions concerning their preparation.

In each subject, various proportions of each group reported that they had at some time experienced a change in the language of instruction of that particular subject. From a quarter to a half of these students reported that they had had some difficulties related to the change in language, but in most cases this seemed to be a short-lived problem with new vocabulary.

The advantages in taking a particular subject in French most frequently mentioned by the students related to the improvement of French proficiency through increased exposure to the language. In both mathematics and geography, the main disadvantage to taking the subject in French was felt to be the difficulty in talking about the subject in English because of lack of knowledge of appropriate terminology, although many also spoke of difficulties with French.

Overview of Results

This preliminary study of subjects taught in French in the early high school grades to students who had been in immersion classes at the elementary level seems to identify certain differences between the subject matter areas. The test results did not seem to indicate any detrimental effect in mathematics of having taken the subject in French. However, it seems likely that reading comprehension in French may have been a limiting factor in the test performance of students of history and geography, who may not have understood some of the expressions used in French-language items well enough to answer them accurately.

Most teachers tended to point out the greater value of history and geography as a means of developing facility in the use of the French language. Students, on the other hand, often spoke of mathematics be-

ing easier to take in French because of the more limited vocabulary needed. They also mentioned frequently specific difficulty with technical vocabulary which they had met in one language and not the other.

In history and geography many teachers appeared to use the practice of deducting marks for errors in French from the total mark awarded on a test or assignment. This procedure was perceived by students as making it inevitable that their marks in these subjects taken in French would be lower than the marks they would have received if they had taken the subject in English.

Both students and teachers were aware of the limited opportunities to speak French in high school classes in history, geography and mathematics. Both also mentioned the difficulties that many students had in expressing themselves in French, and particularly in communicating their opinions and feelings.

Although this study of subjects taught in French did not provide evidence that students had major difficulties in learning various subjects in what is for them a second language, it did show that there were some areas which may need more specific attention. The students seem to feel a need for assistance in learning the vocabulary specific to mathematics and geography in both languages. They also may need help with difficulties in comprehension in both listening and reading, as well as more emphasis on oral communication. Perhaps attention could also be given to the development of appropriate marking procedures and to the provision of more opportunities for language input from a variety of sources. Such changes should add to the already considerable achievements of the bilingual programs in the Ottawa-Carleton area and elsewhere.

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INTRODUCTION

General Background

Since immersion programs for the development of proficiency in French were introduced in the Ottawa area and in other parts of Canada, there has been concern about the appropriate subjects to be taught in French and about the possibility of poorer performance of students who are taught a subject in their second language. In most early-entry programs, starting in kindergarten and grade 1, instruction in nearly all subjects except English language arts has been carried out in French for the first four or five years of the program. In the later elementary grades the the choice of subjects to be taught in French sometimes depends on the background of the immersion teachers. In the case of mathematics the choice of the language of instruction seems to be more often made deliberately; this subject is taught in English in some schools and in French in others. There has been little or no evidence to date of any adverse effect on the achievement of students in the elementary grades (Edwards et al, 1977; Genesee and Stanley, 1976; Genesee, 1978; Gray, 1980; Pawley and Walsh, 1980; Swain and Lapkin, 1981). However, the question continues to be asked at the high school level.

By the beginning of grade 9 the students themselves may have strong opinions on this matter. In the spring of 1979 questionnaires were sent to all students in the first year of an English language high school program who had been in an Ottawa or Carleton late immersion program and to those grade 12 students who had left a high school bilingual program between grade 9 and grade 12 (Morrison et al, 1979).

Most of the 136 respondents to the grade 9 questionnaire had completed the late immersion program and had decided not to continue in the bilingual program, although 30 were taking a special French course designed for graduates of immersion and only three were not taking any French at all. The most frequently given reasons for the decision not to continue in the bilingual program were ones like "I thought I would get better marks in some subjects if I took them in English" (41 per cent said that this was a major influence in the decision and another 28 per cent said it had had some influence). Program choice and characteristics of the school were mentioned somewhat less frequently as major influences, and both difficulty in understanding or using French and characteristics of the teacher or the program were indicated as being of some influence by 15 to 30 per cent of the respondents.

The 42 respondents to the grade 12 questionnaire included a group of 15 who had not been in an immersion program before grade 9; the responses, however, were similar to those of the grade 9 students, with greatest emphasis on marks and course choice. Problems with the use of French and dissatisfaction with the program and the teachers were mentioned as being a major influence in a few cases and as having had some influence in from 15 to 35 per cent of the cases.

In other surveys carried out in 1982 (Morrison et al, 1982), a wider selection of courses offered in French was mentioned in answer to a question about needed improvements in the program by about a quarter of groups of bilingual-program graduates and of grade 12 students in the program. The restrictions on course choice imposed by the relatively limited number of courses given in French was also noted by the graduate group as a negative effect of the bilingual program.

The 1983 contract with the Ministry of Education included as one of two major topics of investigation an examination of the differences in achievement of students taught in English and in French in several subjects where suitable measures were available. An attempt was to be made to correct for aptitude differences between groups and to examine item analysis data for group differences, as well as to obtain information from teachers and students concerning matters related to the language of instruction.

The report of the study of achievement in subjects taught in French and of related questionnaire data will be presented in Part I of this report to the Ministry of Education in fulfilment of the 1983 contract. Part II (bound separately) will deal with the results of the study related to the second major topic, the proficiency of core French students at the grade 10 level.

Programs and Groups Studied

An examination of the subjects taught in French at the high school level and the size of the various groups of students being taught in French showed that in grades 9 and 10 there were sizeable groups who were taking mathematics, history and geography in French. Moreover, in these subject areas, objective tests already developed for use in the Carleton Board of Education could be made available for use in this study. These were based on recent Ontario Ministry guidelines and contained items drawn from the Ontario Assessment Instrument Pool (OAIP) and other sources. Additional details about the specific instruments will be given later.

The grade 9 groups included in the study consisted of all advanced level mathematics classes, whether taught in English or in French, in the three Ottawa bilingual high schools, and all advanced level geography classes in these schools and in one other where geography was being taught in French. At the grade 10 level the students tested consisted of those taking advanced level history in the four schools offering this subject in both English and French. The number of classes involved is shown in Table 1. Although the tests were also administered by the Carleton Board of Education in schools of that board, some of the data were not available in time for inclusion in this report and in other cases the numbers of students having test results were not large enough to form suitable analysis groups.

Table 1 also shows the number of students included in the groups whose results were analyzed for comparative purposes. In addition to the students who were absent on the day of testing, students were not included in the analysis of the classes taught in French or in English if they appeared to have come from a French-speaking family, to have attended a school for francophones, or to have lived for some time in a French-speaking milieu. Others not included were those who were identified as students for whom English was a second language and whose command of English was poor. In the classes taught in French, students were also omitted from the analysis if they had neither a primary- nor a late-entry immersion background prior to grade 9. These decisions were based on information given by the students in a brief survey questionnaire which all students tested were asked to complete. Differences between the number of cases indicated in Table 1 and in later tables occur because data were not available for some students on all of the tests involved in the study.

TABLE 1

NUMBER OF CLASSES AND STUDENTS INVOLVED IN STUDY OF SUBJECTS TAUGHT IN FRENCH, OTTAWA BOARD OF EDUCATION, GRADES 9 AND 10, SPRING 1983

Group	Grade 9 Mathematics	Grade 9 Geography	Grade 10 History
Course taken in French:			
Number of classes	6	11	10
No. of students in analysis group	101	172	162
Course taken in English:			
Number of classes	14	16	16
No. of students in analysis group	251	311	289

In the group of students who were taking mathematics in English it was possible to identify a subgroup (not shown in Table 1) of about 45 students who had taken the subject in French for at least the previous two years but in whose school mathematics was not offered in French at the grade 9 level. Results for these students were analyzed separately.

In all groups being taught history, geography or mathematics in French, all students took the tests involved twice. At the first administration, half of the class took the test first in French while the other half took it in English. This was reversed for the second administration.

Instruments

Mathematics. The test used for grade 9 (advanced) mathematics students was based on one developed for use in the Carleton Board of Education in 1981-82. That test was submitted to the Ottawa Board mathematics consultant and to the mathematics teachers whose classes

would be involved in the study to determine whether the items were suited to the curriculum of that board. The test, originally consisting of 80 items, was reduced to 50 items so that it would be better suited for administration within one class period. In addition, slight modifications were made to a few of the items.

The topics covered by the various items included numerical methods, geometry and algebra. The test was printed in two parts, the first containing items 1 to 30, and the second items 31 to 50. Although in most cases the class periods were long enough to administer both parts at one sitting, the situation at one school which had shorter class periods necessitated the administration of the test in two sittings. The test was also translated into French so that the bilingual program students could take the test in both French and English, as mentioned earlier.

Geography. The geography tests used with grade 9 (advanced) geography students in the spring of 1983 were selected from a set of six parallel tests developed in 1982 for use in the Carleton Board of Education. The Ontario Ministry of Education objectives provided a basis for the selection of test items which were examined for appropriateness to the Carleton Board curriculum. Many of the items were drawn from the Ontario Assessment Instrument Pool (OAIP), although other sources were also used to some extent. Both content and skill objectives were measured with items at high and low cognitive levels.

The geography tests, which were available in both English and French, were submitted to the Ottawa Board geography consultant to determine which were preferred for administration in that board. It was

decided that the classes taking geography in French should take different forms of the test in French and in English and the classes taking geography in English should all take the same English test. Each of the two tests chosen consisted of 41 items with similar content; they also had similar mean scores, standard deviations and test reliability, based on testing about 400 students in the Carleton Board in the previous spring (Bennett, 1982).

The geography tests were printed in two parts to provide some flexibility in the administration. This seemed to be essential from the point of view of the high schools involved in the study, some of which found it impossible to provide the two consecutive class periods required for the administration of the complete test.

History. The instrument selected for administration to grade 10 (advanced) level history students had been prepared for an intermediate history evaluation in the Carleton Board of Education following the Ontario Ministry of Education guidelines for history at this level. It was submitted to the Ottawa Board history consultant for his approval of the suitability of the items for use in that board. The original test had consisted of three separate 25-item parts, dealing with English-French relations, Government and Law in Canada and Canadian-American relations. This test did not cover the fourth area of the grade 10 Canadian history course, "Canada and the World", because it had been felt that the content covered in this area by various classes in the Carleton Board would be likely to differ considerably. This was also the opinion of the consultants and teachers in the Ottawa Board.

For administration in the spring of 1983 the history test was printed in two sections: the first contained the 25 items on English-French relations and the second the 50 items on Government and Law in Canada and on Canadian-American relations. As for the other tests, this arrangement allowed some flexibility in the administration procedures. The French version of the same test was administered to students taking grade 10 history in French.

Validity of instruments. As has already been mentioned, the content validity of the test in each subject was assessed by the consultant for that subject. It will be recalled that some modifications were made in the original mathematics test and that two parallel but different subtests were used in geography.

For each of the groups tested, class marks assigned by the teacher were obtained for the term ending in January. As further indication of the validity of the tests correlations between each of the tests and the corresponding school marks were obtained for each of the analysis groups. Table 2 gives results of these comparisons; the correlations are somewhat lower for history and geography, possibly reflecting the somewhat more limited content of these tests as well as the greater difficulty in producing good objective items in these subject matter areas. The correlations in all cases are significant at the 0.001 level and show a common variance of from 20 to 50 per cent between the measures being compared.

TABLE 2

RELATIONSHIP BETWEEN TEACHERS' MARKS AND ACHIEVEMENT TESTS IN THREE SUBJECTS TAKEN IN ENGLISH OR FRENCH, OTTAWA, SPRING 1983

Subject and grade	Language of test	Subject taken in English		Subject taken in French	
		r	N	r	N
Mathematics 9	English	0.67	219	0.67	102
Mathematics 9	French	—	-	0.69	106
Geography 9	English	0.53	270	0.44	199
Geography 9	French	—	-	0.59	179
History 10	English	0.52	267	0.44	163
History 10	French	—	-	0.43	160

Correlations could also be obtained between the English and French-language versions of the tests for the bilingual class groups, since they took each test in both languages, half with the English test first and the rest with the French test first. For the two groups which took the same test in both languages, the correlations of 0.89 for mathematics and 0.85 for history reflects a high level of equivalence. For geography, where different test items were used in French and in English, the lower correlation of 0.65 probably reflects the differences in specific content.

For mathematics one other comparison was possible, since all Ottawa students take a mathematics test at the beginning of grade 9 as part of the city-wide testing program. The predictive validity of the test given at the beginning of grade 9 was about 0.70, using as the criterion the end of grade 9 mathematics test prepared for this study. As shown in Table 2, the results were very similar (0.67 to 0.69) when

teachers' January marks were used as the predictor of the same end-of-year test.

Measures of internal consistency (KR-20) ranged from 0.83 to 0.88 for the mathematics and history tests and from 0.76 to 0.78 for those used in geography.

Aptitude. In previous studies at the elementary level in the Ottawa and Carleton Boards (Pawley, 1980) it had been found that mean scores on scholastic aptitude tests for the students in French immersion classes tended to be higher than mean scores of those in the regular English stream. Since the City-Wide Testing program of the Ottawa Board of Education includes such tests at the grade 9 level, it was possible to examine differences between the groups involved in the current study. One test which is administered annually in September is the Differential Aptitude Test, Form L (Bennett, et al., 1966) and scores on three subtests were available: Verbal Reasoning (VR), Numerical Ability (NA) and Abstract Reasoning (AR). The Henmon-Nelson Test of Mental Ability, Level 9-12 (HN) is also given in many schools, and these scores were also available.

Student questionnaires. Each student tested in one of the three subject areas was also asked to respond to a questionnaire asking about school background since grade 4, including any experiences in a school for francophones or learning that subject in French. Some of these questions were primarily intended to provide information to sort students into appropriate analysis groups. They were also asked how well

they felt they were prepared to take further courses in the subject and how well they liked it.

The students taking each subject in French were also asked what opportunities they had had to learn French and what subjects they thought were suited to being taught in French. There were also questions on the advantages and disadvantages of taking the subject in French, ways of making the program even more successful, and any experiences they might have had involving a change in the language of instruction.

Teacher questionnaires. The teachers of all classes tested were asked to complete a questionnaire relating to the attitudes of the students toward the subject with particular attention to the experiences of students who had changed from one language of instruction to another. Questions were asked concerning the measures taken to facilitate the transition and the teachers' opinion of such a change in the language of instruction. Those teaching the subject in French were also asked about the degree of proficiency of the class, both in French and in the subject area, what proportion of the students had taken the subject in French recently, and whether students would have been better prepared had they taken it in English. They were also asked to comment on any advantages or disadvantages to teaching the subject in French, to describe methods used to teach the language as well as the subject, and to indicate which subjects they felt were suited to being taught in French.

TEST RESULTS: ANALYSES

Group Differences in Scholastic Ability

For each of the aptitude tests, the mean and standard deviation of the scores were obtained for the groups identified in terms of the language of instruction in mathematics and geography at the grade 9 level and in history at the grade 10 level. For mathematics it was also possible to identify an additional subgroup, consisting of about 45 students in one school where grade 9 mathematics was not offered in French but who had taken it in French for the two preceding years. Table 3 shows the results of the ability tests for the main analysis groups.

It will be seen that for each of the four ability measures, the group taking a subject in French scored significantly higher than the group taking it in English. In the case of mathematics, the additional group who had taken mathematics in French in grades 6 to 8 but who were taking it in English in grade 9 tended to be similar in ability to the group of students currently taking mathematics in French. Most students in both of these groups were in the high school bilingual program and had previously been enrolled in an elementary school immersion program. These differences between groups in the French-language and English-language classes underline the necessity for statistical control of the results for these differences in ability.

TABLE 3

RESULTS ON TESTS OF ABILITY FOR SUBJECT-MATTER ANALYSIS GROUPS, GRADES 9 AND 10, OTTAWA, SPRING 1983

Test	Mathematics Groups					
	Mathematics in English (no recent math in Fr.)			Mathematics in French		
	Mean	SD	N	Mean	SD	N
DAT: Verbal Reasoning	21.9	8.6	263	27.5*	8.3	111
Numerical Ability	22.1	6.0	266	23.8*	6.1	111
Abstract Reasoning	34.7	8.5	265	38.7*	5.1	111
Henmon-Nelson	55.2	10.5	230	62.5*	8.7	82

	Geography Groups					
	Geography in English			Geography in French		
	Mean	SD	N	Mean	SD	N
DAT: Verbal Reasoning	22.7	8.9	327	26.4***	8.3	179
Numerical Ability	22.3	6.3	331	24.2***	5.8	179
Abstract Reasoning	34.8	8.5	330	38.6***	5.8	180
Henmon-Nelson	55.1	10.2	205	61.5***	9.4	136

	History Groups					
	History in English			History in French		
	Mean	SD	N	Mean	SD	N
DAT: Verbal Reasoning	22.8	9.1	244	26.8***	8.8	163
Numerical Ability	22.8	6.4	244	24.1*	6.7	163
Abstract Reasoning	36.0	6.7	244	38.8***	5.0	163
Henmon-Nelson	55.8	10.3	121	60.8***	9.1	98

* Mean of this group significantly greater than that of the group taking the same subject in English ($p < 0.05$)

*** Mean of this group significantly greater than that of the group taking the same subject in English ($p < 0.001$).

Relationship between Aptitude and Achievement Measures

Pearson product-moment correlation coefficients between various variables were calculated for the analysis groups taking the three achievement tests in English or in French in the spring of 1983. The results for the aptitude tests are shown in Table 4.

For the mathematics achievement test the correlations with the four aptitude measures ranged from 0.40 to 0.65 for the groups taking the test in either English or French. Since the Numerical Ability measure showed the strongest relationship with mathematics achievement test scores, the results on that aptitude test were used as the covariate in the analysis of differences between groups. In the groups being analyzed, from 35 to 40 per cent of the variance was shared between these two measures.

Table 4 also shows the relationship between each of the four tests of mental ability and the achievement tests in history and geography, for the two analysis groups used in examining these test results. Since the DAT Verbal Reasoning scores tended to have the largest correlations with the results of the history and geography tests, these scores were used in the analysis of covariance for both sets of results. The Henmon-Nelson scores also had high correlations with the test results in these two subjects, but they were available for a smaller number of students.

TABLE 4

PEARSON CORRELATION COEFFICIENTS BETWEEN TESTS OF MENTAL ABILITY AND ACHIEVEMENT TESTS FOR VARIOUS ANALYSIS GROUPS, GRADES 9 AND 10, OTTAWA, SPRING 1983

	Group taking subject in Eng.		Group taking subject in Fr.	
	r	N	r	N
Mathematics Test (English)* vs				
Verbal Reasoning	0.49	228	0.46	97
Numerical Ability	0.64	231	0.65	97
Abstract Reasoning	0.42	230	0.44	97
Henmon-Nelson	0.50	204	0.57	70
Mathematics Test (French) vs				
Verbal Reasoning	—	-	0.40	101
Numerical Ability	—	-	0.60	101
Abstract Reasoning	—	-	0.47	101
Henmon-Nelson	—	-	0.52	74
Geography Test (English) vs				
Verbal Reasoning	0.57	267	0.51	193
Numerical Ability	0.45	271	0.40	193
Abstract Reasoning	0.41	270	0.44	194
Henmon-Nelson	0.53	169	0.51	149
Geography Test (French) vs				
Verbal Reasoning	—	-	0.48	168
Numerical Ability	—	-	0.47	168
Abstract Reasoning	—	-	0.40	168
Henmon-Nelson	—	-	0.48	126
History Test (English) vs				
Verbal Reasoning	0.64	242	0.59	156
Numerical Ability	0.40	242	0.44	156
Abstract Reasoning	0.35	242	0.32	156
Henmon-Nelson	0.64	120	0.59	92
History Test (French) vs				
Verbal Reasoning	—	-	0.60	152
Numerical Ability	—	-	0.41	152
Abstract Reasoning	—	-	0.42	152
Henmon-Nelson	—	-	0.66	87

* For the mathematics test a small group of bilingual program or former immersion students who were taking mathematics in English is not included.

Analysis of Covariance

Using as the covariate the aptitude measure which seemed most suitable in each case (DAT Numerical Ability for mathematics and DAT Verbal Reasoning for history and geography) an analysis of covariance (ANCOVA) was carried out in each case in order to control the results statistically for differences in ability. The adjusted mean scores for each of the groups on the three achievement tests are given in the sections of this report which follow, as well as the unadjusted scores for the same groups. The groups used in these analyses are in each case somewhat smaller than the groups tested, since only the students with scores on both the ability measure and the achievement test could be included.

Item Analysis

It was possible to compare the results of the various groups on each individual item of each achievement test taken in English and also to compare the results of the bilingual program group taking a subject in French on the items of the French and English versions of the test. Chi-square tests of significance were performed to determine whether differences between groups on any one item were statistically significant. For the geography test it was not possible to compare the items on the French-language test with those on the test given in English, since the content of the two tests was different. The item analysis data for each of the achievement tests are given in the section on results for the specific subject area.

Other Comparisons

The results of each of the achievement tests were examined for sex differences. In addition, it was possible to make comparisons between the results obtained in the bilingual program classes for the tests taken in English and in French. Comparisons could also be made to determine whether the order of each language of testing had influenced the results.

TEST RESULTS: MATHEMATICS (GRADE 9)

Differences between Groups

In the spring of 1983 the mathematics test described earlier was administered both in English and in French to all grade 9 advanced level classes taking mathematics in French in the Ottawa Board of Education. The same test was administered in English to the classes taking the same mathematics course in English in the three Ottawa bilingual high schools. In one school, mathematics was not offered in French at grade 9. Therefore, for the purpose of studying this subject area, three analysis groups were formed:

(1) about 100 bilingual-program students taking mathematics in French

(2) about 45 students in the school which did not offer grade 9 mathematics in French who were taking mathematics in English after taking it in French in at least grades 7 and 8 (usually still bilingual-program students)

(3) about 230 students taking mathematics in English after not taking it in French at the grade 7 or 8 level (usually students enrolled in the regular English program).

It was seen earlier that the bilingual program group taking mathematics in French had significantly higher scores on all the ability measures than the regular program group taking mathematics in English with no recent experiences of mathematics in French. The small group taking mathematics in English after recently taking it in French also differed significantly from the group with no recent French math on two of the four ability measures. These facts necessitated an analysis of covariance of the mathematics results in order to control statistically for differences in ability. Since the strongest relationship between the four ability measures and the mathematics test was with the

Numerical Ability measure, the results on that test were used as the covariate.

The scores on the two mathematics measures, adjusted for differences in Numerical Ability, are shown in Table 5, along with the unadjusted scores for the same group of students for whom the adjusted scores were calculated. In addition, data for the second subgroup described on the previous page are included in the results shown in Table 5.

TABLE 5

MATHEMATICS RESULTS, ADJUSTED FOR DIFFERENCES IN NUMERICAL ABILITY, GRADE 9 ANALYSIS GROUPS, OTTAWA, SPRING 1983

Language of test	Type of mean	French instruction			Eng. instruction, recent Fr. math			English instruction		
		Mean	SD	N	Mean	SD	N	Mean	SD	N
English	Unadjusted	34.9*	8.4	97	32.1	6.8	44	28.7	8.2	231
	Adjusted	34.0*		97	31.9		44	29.4		231
French	Unadjusted	34.4*	8.1	101		na			na	
	Adjusted	33.9*		101		na			na	

* Mean of this group significantly greater than that of group taking math in English and having no recent experience of math in French ($p < 0.05$).

Even after adjustment for ability, the bilingual program group taking mathematics in French performed significantly better on the mathematics test taken either in French or in English than the group taking mathematics in English after no recent exposure to it in French. The adjusted mean score on the English-language test for the smaller group taking mathematics in English after having had instruction in

French in grades 7 and 8 was not significantly different from the mean scores of the two larger groups.

On the city-wide test in mathematics taken by grade 9 students at the beginning of the school year, the group taking mathematics in French and the smaller group taking it in English after recent experience with it in French had significantly higher mean scores than those in the regular English program who had not had recent exposure to mathematics instruction in French. These differences are similar to those found on the aptitude tests given at the same time of year, which were reported in Table 3, with differences significant at the 0.05 level. When the results of the city-wide mathematics test were adjusted for differences in ability, using the Numerical Ability scores as covariate, the differences no longer reached significance. Adjusted and unadjusted means for all three groups are shown in Table 6.

Results of an analysis of the class marks given by teachers at the middle of the year are also included in Table 6. In this case, however, after correction for aptitude, the differences between the group taking mathematics in English with no recent exposure to instruction in French and the groups with recent or current instruction in French remained. The direction of the differences was the same as for the mathematics test given at the end of the year, the mean class mark being lower for the main analysis group taking mathematics in English. Although the class marks were given by different teachers in most cases, these mid-year results are consistent with those obtained by using a common objective mathematics test near the end of the school year (see Table 5).

TABLE 6

RESULTS ON CITY-WIDE MATHEMATICS TEST AND TEACHERS' JANUARY MATHEMATICS MARKS, ADJUSTED FOR DIFFERENCES IN NUMERICAL ABILITY, GRADE 9 ANALYSIS GROUPS, OTTAWA, 1982-83

Test and type of mean	French instruction			Eng. instruction, recent Fr. math			English instruction		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
City-Wide Testing									
Unadjusted	31.6*	8.2	110	33.0*	8.3	44	28.6	8.0	263
Adjusted	30.5		110	32.2		44	29.2		263
Teachers' Class Marks									
Unadjusted	75.4*	14.9	105	79.5*	10.7	41	64.3	17.4	236
Adjusted	73.7*		105	77.5*		41	65.4		236

* Mean for this group significantly greater than that of group taking mathematics in English and having no recent experience of mathematics in French ($p < 0.05$).

Item Analysis Data

It was possible to compare the results of the various groups on each individual item of the mathematics test taken in English and also to compare the results of the bilingual program group taking mathematics in French on the items of the French and English versions of the test. For each item on the test in both languages, Table 7 shows the percentage of students in the two larger analysis groups who gave the correct answer. This table also indicates the nature of the content of each item. Chi-square tests were used to determine whether differences between groups on any one item were statistically significant. Significant differences between groups are also indicated in Table 7 ($p < 0.05$).

TABLE 7

ITEM DIFFICULTIES FOR ENGLISH AND FRENCH VERSIONS
OF GRADE 9 MATHEMATICS TEST, FRENCH AND ENGLISH INSTRUCTIONAL GROUPS,
OTTAWA, SPRING 1983

Item no. and content		Per cent correct		
		Fr. test	English test	
		Fr. inst.	Fr. inst.	Eng. inst.
Part 1				
1	Order of operations	67	56	60
2	Decimal equivalent of fraction	85	88	81
3	Decimal converted to a fraction	66	72*	42
4	Decimal converted to a per cent	79	82*	66
5	Addition of polynomials	87	82	79
6	Subtraction of binomials	60	62	62
7	Scientific notation	66	62	64
8	Per cent converted to a fraction	84	85	74
9	Per cent converted to a decimal	71	63*	41
10	Mixed no. converted to a per cent	43	38	28
11	Expression of product in scientific notation	45	45	44
12	Multiplying powers of 2	64	58*	40
13	Addition of fractions with unlike denominators	77	77	78
14	Division of mixed number by a whole number	88	89*	79
15	Division of two mixed numbers with reduction	84	81	75
16	Addition of negative integers	88	93	92
17	Subtraction of negative imtegers	88	85*	75
18	Multiplication of integers	94	94	94
19	Multiplication of fractions with reduction	70	69	59
20	Odd power of a negative integer	97	92	90
21	Division involving powers of x	56	51*	37
22	Multiplying powers of m	93	95*	81
23	Dividing powers of 2	55	59*	40
24	Multiplication involving powers of x	90	92	85
25	Squaring a monomial	73	75*	50
26	Finding a power of a quotient	66	68	57
27	Multiplying a polynomial by a monomial	79	73*	61
28	Multiplying a polynomial by a monomial	91	89*	77
29	Dividing a polynomial by a monomial, exact division	79	80*	69
30	Multiplying two binomial expressions	80	77	73

. . . . cont.

TABLE 7, cont.

Item no. and content	Per cent correct		
	Fr. test	English test	
	Fr. inst.	Fr. inst.	Eng. inst.
Part 2			
31 Rewriting a quotient involving negative exponents	26	34	26
32 Finding the area of a rectilinear region	91	95*	75
33 Writing an algebraic expression for a perimeter	79	79*	61
34 Writing an algebraic expression for the perimeter of a right triangle	86	80	70
35 Finding the hypotenuse of a right triangle	70	72*	42
36 Finding square root	44	50	49
37 Evaluating a negative power of 2	57	57*	33
38 Evaluating an expression involving the power 0	55	55*	35
39 Finding a common factor in a binomial expression	73	72*	58
40 Substitution of numerical values in an algebraic expression involving x and y	63	75*	59
41 Finding y from an equation in x, y and z	60	57	48
42 Identifying the solution set of an inequality (graph)	31	39*	20
43 Identifying the solution set of an inequality	45	48*	31
44 Solution of linear equation with fraction coefficients	46	53*	39
45 Solution of linear equation	67	77*	61
46 Word problem involving ages	45	40	36
47 Two-step word problem involving fractions	77	71	64
48 Word problem involving money	42	48*	34
49 Word problem involving rates of speed	66	66	56
50 Word problem involving variables in a linear expression	42	33	32
No. of students	113	109	261
Mean score	34.1	34.4	28.8
S.D.	8.0	8.3	8.2

* Difference between group taking math in French and group taking math in English on the English version is significant ($p < 0.05$). Results are <u>not</u> adjusted for differences in the aptitude of groups (see text).

On 25 items there were significant differences on the English version of the test between the English instruction group with no recent exposure to mathematics in French and those who had been instructed in French, and all of these differences were in favour of the latter group. When the item analyses of the French and English versions of the test were examined for the group taking mathematics in French, no significant differences between the results on any of the items were found. It was not possible to correct these results for the ability of the students, but it will be recalled that significant differences in mean scores remained after correction for differences in ability between the groups.

Order of Administration with Respect to Language

As noted earlier, the bilingual program group taking mathematics in French took the same test in both French and in English. Half the class took it in English first and the other half in French first; the language of testing was then reversed for the second administration. The results for each language were analyzed separately according to the order of administration to try to determine whether there was a difference in performance related to this order. These results are shown in Table 8. There were no significant differences between the results of the two administrations for the tests of either language.

TABLE 8

RESULTS ON GRADE 9 MATHEMATICS TEST,
BY LANGUAGE OF TEST AND ORDER OF ADMINISTRATION,
FRENCH INSTRUCTIONAL GROUP, OTTAWA, SPRING 1983

	Administered First			Administered Second		
	Mean	SD	N	Mean	SD	N
Test taken in English	33.2	8.5	58	35.6	7.9	51
Test taken in French	34.2	7.4	56	34.0	8.5	57

Results Analyzed by Sex

The results of all students who took the mathematics test in English and of the bilingual program students who also took it in French were analyzed by sex and the results adjusted for differences in Numerical Ability. These results are shown in Table 9. There were no significant differences between the adjusted mean scores of girls and boys on either the French or the English test. It had also been found that there were no significant differences between the sexes on any of the four ability measures, including Numerical Ability.

TABLE 9

GRADE 9 MATHEMATICS TEST RESULTS ANALYZED BY SEX,
OTTAWA, SPRING 1983

	Test taken in English			Test taken in French		
	Adj. Mean	SD	N	Adj. Mean	SD	N
Girls	30.9	8.9	212	34.8	8.7	57
Boys	31.4	8.0	164	33.5	7.7	44

TEST RESULTS: GEOGRAPHY (GRADE 9)

Differences between Groups

The English-language geography test described earlier was administered to all grade 9 advanced level classes taking geography in French in the Ottawa Board and to the classes taking the same course in English in those schools. It should be remembered that the French instruction group took a different version of the test in French. The French instruction group included some students at one school taking only geography in French, as well as bilingual-program students in three schools.

Since the group taking geography in French was found to have significantly higher mean scores on all four ability measures than the group which was taking it in English, it was essential to conduct an analysis of covariance in order to take into account these differences in ability. Although there was little difference among the available aptitude measures, the relationship with geography test scores tended to be slightly greater for the Verbal Reasoning subtest of the DAT. As a consequence, these scores were used in an attempt to control for differences in ability. Table 10 shows the unadjusted and adjusted mean scores for those groups of students who had scores on both geography and ability tests.

TABLE 10

GEOGRAPHY RESULTS, ADJUSTED FOR DIFFERENCES IN VERBAL REASONING ABILITY, GRADE 9 FRENCH AND ENGLISH INSTRUCTIONAL GROUPS, OTTAWA, SPRING 1983

Test and language of test	Type of mean	French instruction			English instruction		
		Mean	SD	N	Mean	SD	N
Geography (Eng)	Unadjusted	25.0#	5.1	169	24.5	5.6	291
	Adjusted	24.4#		169	25.2#		291
Geography (Fr)	Unadjusted	23.4	5.9	168	—	-	-
	Adjusted	22.8		168	—	-	-
Teachers' Class Marks (Eng or Fr)	Unadjusted	70.3*	14.5	172	64.8	13.8	312
	Adjusted	68.5		172	65.9		312

* Mean of this group significantly greater than that of the English instruction group ($p < 0.001$).

\# Mean of this group significantly greater than that of the French instruction group on the French form of the test ($p < 0.05$).

The students in the French instructional group obtained a significantly higher mean score on the test taken in English compared to the mean score of the same students on the French version. On the geography test taken in English there were no significant differences in mean scores between the French and English instructional groups either before or after adjustment for ability. In addition, once the results were adjusted for differences in Verbal Reasoning, the mean score for the English instruction group was significantly higher on the test taken in English than the mean for the bilingual program group on the test taken in French. However, it has already been indicated that the test taken in French was different from the one taken in English, although a previous administration to a large sample had indicated that

the two versions were equivalent in difficulty as well as similar in content. Caution should therefore be used in comparing the results of the geography tests given in different languages. In the case of the history test to be discussed in the next section, the test content was the same for the tests given in English and in French.

The results for the geography tests seem to suggest that although the two instructional groups had mastered the same content, the French-language instructional group may have been somewhat handicapped by the language of the test when taking the French version. The geography results also differed from the results of the analyses of the grade 9 mathematics testing, on which the bilingual program group taking mathematics in French had significantly higher adjusted mean scores than the regular program group on the tests in both languages.

The January class marks in geography assigned by the class teachers were also compared. Before adjustment for ability the mean class mark for the group taking geography in French was significantly higher than that for the group taking it in English. Once these results were adjusted for differences in ability, however, there were no significant differences between the two. Assuming that the teachers of the two groups had used similar scoring criteria, this finding suggests that the content mastered by each group was similar. However, this result is also different from that obtained in mathematics, where the teachers' marks for the bilingual program group were higher even after adjustment for differences in ability.

Item Analysis Data

Item analysis results were obtained for the French and English instructional groups on the geography test taken in English and were examined to determine whether the groups differed significantly on any particular items. Since the test taken in French was a different form, it was not possible to compare the items on this test with those on the English one. Chi-square tests of significance were conducted to determine whether there were any significant differences ($p < 0.05$) between the results of the two groups on any item on the English geography test. Table 11 gives the item difficulties for the two groups on the test taken in English and any cases of significant differences are indicated. An indication of the content of each item is also given in this table. It should be remembered that this analysis does not take into account the differences in the academic ability of the students within these groups.

For only 10 of the items was there a significant difference between the results of the two groups; of these, six were in favour of the French instructional group. It does not appear likely that any of these differences were related to language. Since the French geography test did not consist of the same items it is impossible to tell whether the language of that test seemed to cause lower performance on some items when they were taken in French.

TABLE 11

ITEM DIFFICULTIES FOR GRADE 9 ENGLISH GEOGRAPHY TEST, FRENCH AND ENGLISH INSTRUCTIONAL GROUPS, OTTAWA, SPRING 1983

Item No.	Content	Per cent correct	
		French instruction	English instruction
1	Use of different types of map	63	63
2	Population projection from table	54	61
3	Products shipped from Great Lakes port cities	51	59
4	River boundary between provinces	56	64
5	Interpretation of bar graph and table of interprovincial migration	73	72
6	Definition of "continental shelf"	52	63*
7	Latitude of North Pole	45*	36
8	Identification of Canadian lakes by shape	46	50
9	Location of most hydroelectric sources	59	70*
10	Natural resources of Great Plains	80*	70
11	Definition of "humus"	64	64
12	Major cause of precipitation of Great Lakes - St. Lawrence Lowlands	62*	50
13	Identification and location of Alaska	85	86
14	Transport handling containerized goods	92	89
15	Why Eastern provinces use imported oil	57*	47
16	Use of scale to determine distance on map	17	19
17	Definition of "crop yield"	23	30
18	Latitude of boundary on map of NWT	30	41*
19	Relative size of manufacturing labour force in four provinces	59	70*
20	Factors affecting exploration and development of north	18	21
21	Relative importance of safe disposal of waste from different types of power plant	82	85
22	Interpretation of circle graph	95	95
23	Cause of changes in dominant vegetation	51*	38
24	Comparison of pie charts	90	89
25	Coolest location in summer on cross-sectional profile map	51*	33

. . . cont.

TABLE 11, cont.

Item No.	Content	Per cent correct	
		French instruction	English instruction
26	Relative size of Canadian urban centres	62	58
27	Interpretation of multiple line graph	95	91
28	Meaning of given climate statistics	82	86
29	Factors contributing to industrial activity of St. Lawrence Lowlands corridor	57	53
30	Finding temperature range on temperature/precipitation graph	36	35
31	Direction on map	77	77
The following items use supplementary visual materials:			
32	Finding reason for construction of lock identified by map coordinates	42	48
33	Identification of area enclosed by military grid lines	45	38
34	Identification of most likely map location for specific industry	60	58
35	Reason for location of specific fire tower	83	77
36	Giving direction between two points on map	72	66
37	Using scale to find distance on map	53	49
38	Identifying contour interval of given map	51	54
39	Direction of road from one location to another	64	67
40	Land use at certain location on map	46	51
41	Location of specific feature on map	74	78
	Number of students	202	342
	Mean score	24.5	24.5
	SD	5.1	5.6

* Per cent correct for this group significantly greater than that for the other group ($p < 0.05$).

Order of Administration with Respect to Language

The group taking geography in French took the same test in English as the English instructional group, as well as a different version of the test in French. As described earlier, half the class took the test first in English, while the other half took it in French; the language of testing was reversed for the second administration. The results for each language were analyzed separately according to the order of administration to determine whether there was any difference in performance related to this order. These results are given in Table 12. There were no significant differences either in French or in English between the results of the first administration and the second one ($p < 0.05$).

TABLE 12

RESULTS ON GRADE 9 GEOGRAPHY TEST,
BY LANGUAGE OF TEST AND ORDER OF ADMINISTRATION,
FRENCH INSTRUCTIONAL GROUP, OTTAWA, SPRING 1983

	Administered first			Administered second		
	Mean	SD	N	Mean	SD	N
Test taken in English	24.7	5.2	104	24.3	5.0	98
Test taken in French	22.4	5.1	93	23.0	6.6	99

Results Analyzed by Sex

The results for all students who took the geography test in English or in French were analyzed by sex and the results, adjusted for Verbal Reasoning, are shown in Table 13. Although there was no significant difference between the sexes on the adjusted means on the French version of the test, on the English one the boys had a significantly higher adjusted mean than the girls. The only significant difference between the sexes on the four ability measures was on the DAT Numerical Ability subtest, on which the mean for the boys taking the test in English was higher than that for the girls in the same group ($p < 0.05$).

TABLE 13

GRADE 9 GEOGRAPHY TEST RESULTS ANALYZED BY SEX, OTTAWA, SPRING 1983

	Test taken in English			Test taken in French		
	Adj. Mean	SD	N	Adj. Mean	SD	N
Girls	23.5	5.3	253	23.1	6.0	101
Boys	26.0***	5.4	207	23.8	5.7	67

*** Mean of this group significantly greater than that of the girls on the same test ($p < 0.001$).

TEST RESULTS: HISTORY (GRADE 10)

Differences between Groups

For history, the third subject area considered in the spring of 1983, the same version of the history test was administered in French and in English to all grade 10 advanced level history classes taking history in French in the Ottawa Board. The French instruction group included some students at one school taking only history in French, as well as bilingual-program students at three schools. The English version of the test was given to students taking the same course in English in these four schools.

It has already been seen that there were significant differences between the history analysis groups on all four of the ability measures ($p < 0.05$). An examination of the correlation coefficients between various ability measures and the history tests indicated that those with a verbal emphasis showed the greatest relationship. Since more students had taken the DAT Verbal Reasoning test than the Henmon-Nelson, the Verbal Reasoning scores were used in an analysis of covariance. This made it possible to control statistically for differences between the groups in verbal ability and to obtain mean scores adjusted for such differences. The adjusted history results are shown in Table 14, along with the unadjusted scores for the same groups of students.

For the group of students taking the course in French the mean on the English version of the test was significantly greater than that for the same students on the French version ($p < 0.05$). After the results were adjusted for differences in verbal reasoning ability, the mean score of the English instruction group on the English version of the

test was also greater than that of the French instruction group on the French version ($p < 0.05$). However, there were no significant differences between the English and French instruction groups on the English version of the test. These findings suggest that although the group taking history in French had mastered the same content as the group taking it in English, at least as measured by this test, language difficulties may have prevented the former group from achieving results of the same magnitude on the French version. The item analysis results will be discussed later, with suggestions of possible reasons for this discrepancy.

TABLE 14

HISTORY RESULTS, ADJUSTED FOR DIFFERENCES IN VERBAL REASONING ABILITY, GRADE 10 FRENCH AND ENGLISH INSTRUCTIONAL GROUPS, OTTAWA, SPRING 1983

Measure	French Instruction			English Instruction		
	Mean	SD	N	Mean	SD	N
English History:						
Unadjusted	51.9#	8.0	156	50.5	8.4	242
Adjusted	50.8#		156	52.0#		242
French History:						
Unadjusted	49.1	9.6	152	—	-	-
Adjusted	48.0		152	—	-	-
Teachers' Class Marks:						
Unadjusted	69.9	11.9	155	71.3	14.2	237
Adjusted	68.7		155	72.1*		237

\# Mean of this group significantly greater than that of the French instruction group on the test taken in French ($p < 0.05$).

* Mean of this group significantly greater than that of the French instruction group ($p < 0.05$).

A similar difference in results on the French and English versions of the test had been observed for geography but not for mathematics. The difference in history is consistent with the data for the teacher-assigned history class marks for the January term, also shown in Table 14. These data show that although the unadjusted means of the English and French instruction groups did not differ significantly, the adjusted mean of the English instruction group was significantly greater than that of the French instruction group.

Item Analysis Data

It had been felt that an examination of item analysis data of the groups might help to explain some of the differences in mean scores. Table 15 shows the percentage of students who gave the correct answer on the history test taken in English by both instructional groups and on the history test taken in French by the French instruction group. Comparisons were made between the two groups on the English test and between the results on the two versions for the French instruction group. The table indicates items showing significant differences between groups and the direction of these differences.

TABLE 15

ITEM DIFFICULTIES FOR ENGLISH AND FRENCH VERSIONS OF GRADE 10 HISTORY TEST, FRENCH AND ENGLISH INSTRUCTIONAL GROUPS, OTTAWA, SPRING 1983

Item no. and content		Per cent correct		
		Fr. test	English test	
		Fr. inst.	Fr. inst.	Eng. inst.
ENGLISH-FRENCH RELATIONS				
1	British reasons for Quebec Act	71	70	77
2	General intent of Quebec Act	74#	64	76*
3	Main purpose of Constitutional Act	22	16	23
4	Aims of Durham Report	52	46*	31
5	H. Bourassa's view of British imperialism	38	40	52*
6	Laurier's attitude towards conscription	31	32	45*
7	Evaluation of historical sources	55	68#	66
8	Identification of "Quiet Revolution"	71	69*	60
9	Definition of "federalist"	70	79*	63
10	Factors contributing to Quebec nationalism	60	66	59
11	Identification of an opinion vs fact	86	90*	78
12	Original meaning of "Métis"	89	87	88
13	Identification of Thomas Scott	82	85	76
14	Chronology of Northwest Rebellion	67	77#	73
15	Probable area explored by Vikings	69	67	69
16	Results of fur trade in New France	31	42#	40
17	Reasons for early competition in North America	89	88	89
18	Conclusions drawn from reading passage about Acadia	70	85#	85
19		75	77	80
20	First bishop of New France	18	20	19
21	Meaning of "Habitant"	42	63#	68
22	Characteristics of seigneurial system	67	75	72
23	Problems in defending New France	26	29	33
24	Outcomes of the fall of New France	56	66	60
25	Groups in Canadian West before Confederation	45	44	47

. . . cont.

TABLE 15, cont.

Item no.	and content	Per cent correct: Fr. test Fr. inst.	English test Fr. inst.	English test Eng. inst.
GOVERNMENT AND LAW IN CANADA				
26	Name of Canada's constitution	17	34#	54*
27	Most powerful part of Canadian parliament	69	77	83
28	Description of Canadian Senate	79	80	74
29	Political parties in House of Commons	97	93	97*
30	Meaning of "legislative"	85	88	88
31	Bodies making laws	83	83	85
32	Types of government systems	74	72	72
33	Essential aspect of democracy	73	77	73
34	Chief executive of local government	78	77	75
35	Identification of sales tax	97	98	98
36	Meaning of "election polling station"	83	85	89
37	Correctly marked ballot	89	90*	82
38	Essential element for functioning of society	78	91#	90
39	Purpose of law	94	98	97
40	Meaning of "due process of law"	73	72	71
41	Responsibility of police	79	98	97
42	Example of law enforcement	67	93#	91
43	Rights when arrested	82#	73	80
44	Document which defines crimes	90	88	84
45	Definition of crown attorney	67	63	58
46	Verdict in cases involving trial by judge and jury	68	71	71
47	Reason for appointment of judges	71	71	70
48	Responsibility of jury	92	96	97
49	Type of court for juvenile crimes	90	95	94
50	Type of trial for assault and wounding police officer	81	88	84
CANADIAN-AMERICAN RELATIONS				
51	Description of War of 1812	51	53*	39
52	Meaning of "continentalism"	62	63	59
53	Protection of Canadian economy by 1879 National Policy tariff	81	88	86
54	Other part of National Policy	82	86	85
55	Meaning of "free trade"	75	72	81*

. . . cont.

TABLE 15, cont.

Item no. and content		Per cent correct		
		Fr. test	English test	
		Fr. inst.	Fr. inst.	Eng. inst.
56	Meaning of "extraterritoriality"	35	37	31
57	Countering impact of American media in the 1920s	53	67#	76*
58	North American Air Defence system exports in 1917	29	42*#	30
59	Reason for increase in Canadian exports in 1917	66	71	65
60	Identifying date in export table	78	39@	30@
61	Identifying period of slump in export table	64	71	70
62	Matching of Canadian Prime Ministers with event in Canadian American relations	34	31*	15
63		51	51	50
64		20	27*	19
65		53	56*	46
66	Limits of territorial waters	63	68	69
67	Interpretation of graph showing Canadian imports between 1961 and 1979	21	23	23
68		78	88*#	74
69		81	89*#	78
70	Matching of government organizations and agencies with description of activities	49	49	51
71		71	81#	76
72		78	84	78
73		85	93#	88
74		87	93#	86
75	Development of Canadian cultural identity	66	69*	55
No. of students		175	177	305
Mean score		49.2	51.8	50.5
SD		9.7	8.5	8.4

* Per cent correct on the test taken in English is significantly greater for this group than that for the group receiving instruction in history in the other language ($p < 0.05$).

\# Per cent correct for French instruction group is significantly greater on this test than on the test taken in the other language ($p < 0.05$).

@ A typographical error in the English test was discovered after the analyses were completed. Two responses were labelled 'd', one of them being the correct response, 'c'. The per cents reported represent those who marked response 'c' and are likely to be underestimates of the difficulty of this item.

About 40 per cent of the items showed significant differences between the two groups on the test taken in English or between the results in the two languages for the group taught in French. On the English test there were 13 items in which the proportion of correct responses was significantly greater for the group taking history in French and 7 items on which this proportion was greater for the group taking the course in English. For the group taking history in French, there were 15 items on which the proportion of the students answering the English item correctly was significantly higher than the proportion answering the French item correctly, and only two cases of a significant difference in the opposite direction.

On six items the French instruction group significantly surpassed the English history group on the test written in both languages. One of these (item 8) referred to the Quiet Revolution in Quebec, a topic which might have had more emphasis in the classes taught in French. On another 7 items the French instruction group did significantly better than the English group only on the test written in English. Sometimes this may have resulted from a different emphasis in instruction, although information on specific curriculum emphasis is not available.

On a couple of items the English instruction group performed significantly better than the French instruction group did in either language, although the latter group did substantially better in English than in French. One such item (26) which asked for the name of the document of the Canadian constitution was not very well done by either group and the French instruction group did particularly poorly on the French version. In another case the French version contained terms which may have caused difficulty in reading comprehension.

When the data obtained on the French and English versions of the test for the group taking history in French were examined, it appeared that in several items certain words or constructions might have caused the difficulty. Only two items (items 2 and 43) were found on which the results were significantly better on the French version than on the English one for the group taking history in French. There were, however, 15 items on which the French instruction group performed better in English than in French.

The item (42) with the greatest difference between the French and English versions for the group being instructed in French was answered correctly by 67 per cent on the test taken in French and by 93 per cent on the English version. The stem of this question was longer and more detailed in French than in English and also contained vocabulary which could also have caused difficulties. Some of the other items which seemed to cause more difficulty to the students when taking the test in French contained such possible vocabulary difficulties as 'cultivateur à bail', 'ils défrechèrent', 'a déclanché un remous international', and 'incombe'.

Order of Administration with Respect to Language

As noted earlier, the French instruction group took the test both in English and in French, with half the class writing it first in English and the other half in French; this was reversed for the second administration. Table 16 shows that, although there was no significant difference in the English test scores between the two administrations, the group which took the test in French after they had already taken it in English performed significantly better than the group which took it in French first.

TABLE 16

RESULTS ON GRADE 10 HISTORY TEST,
BY LANGUAGE OF TEST AND ORDER OF ADMINISTRATION,
FRENCH INSTRUCTIONAL GROUP, OTTAWA, SPRING 1983

	Administered first			Administered second		
	Mean	SD	N	Mean	SD	N
Test taken in English	52.3	8.1	82	51.3	8.9	95
Test taken in French	47.2	9.7	93	51.5**	9.1	82

** Mean of this group significantly greater than that of the group which took the test in French before taking it in English ($p < 0.01$).

Results Analyzed by Sex

The results on both the English and the French versions of the test were analyzed by sex and adjusted for differences in Verbal Reasoning. Table 17 shows that on the test taken in English the boys scored significantly higher than the girls. It had been found that on each of the four ability measures the mean score of the boys was higher than that of the girls, although these differences only reached significance for Numerical Abilty ($p < 0.05$).

TABLE 17

GRADE 10 HISTORY TEST RESULTS ANALYZED BY SEX,
OTTAWA, SPRING 1983

	Test taken in English			Test taken in French		
	Mean	SD	N	Mean	SD	N
Girls	50.0	7.7	207	48.0	9.4	80
Boys	52.3***	8.7	190	50.2	9.8	71

*** Mean of this group significantly greater than that of the group of girls on the test taken in the same language ($p < 0.001$).

QUESTIONNAIRE RESPONSES: INTRODUCTION

It has already been noted that questionnaires were completed by all students tested in one of the three subject areas and by teachers of these classes, in order to obtain more subjective information about the opinions of both students and teachers concerning certain aspects of their courses, particularly those pertaining to the language of instruction. These data are used to supplement the results of the objective tests in mathematics, geography and history which have been discussed in the preceding sections of this report. The present section provides further details regarding the questionnaires, which were discussed briefly in the general introduction to this report, and describes the analysis groups of respondents. The sections which follow will deal with questionnaire responses in each of the three subject areas.

Student Questionnaires

All the students tested in the spring of 1983 were asked to complete questionnaires which asked about their school background since grade 4, any experiences they had in a francophone school or in taking that particular subject area in French, how well prepared in that subject area they were and how well they liked it. Those taking the subject in French were also asked what opportunities they had had to learn French outside of school, what advantages and disadvantages they saw in taking that particular subject in French, what improvements could be made with respect to learning either the subject matter or the French language, and what subjects they thought were best suited to being

taken in French. Both groups were asked whether they had ever switched the language of instruction of the subject in question from French to English or vice versa, and if so, whether they had experienced any problems with the change.

The first two or three questions were used to make decisions about the analysis group in which each student belonged. These questions yielded information about whether the student had been in an immersion or bilingual program and whether the subject was taken in French or in English for each of a number of years, as well as the location of the school attended. Details about attendance at a francophone school were given in the second question, and in the third, families that were French speaking were likely to be mentioned.

For each subject area the questionnaires were analyzed for the same English and French instruction groups as were used in the analyses of the test results. Further details about the backgrounds of students included in the analysis groups and of those who were not included in these groups were given in the introductory section entitled "Programs and Groups Studied" and more information will be given with the questionnaire responses in each subject area. Table 18 shows the size of the analysis groups for the student questionnaires in each subject area tested.

The questionnaires of students whose test results were not included in the previous analysis were also examined separately for each of the English and French instruction groups. Chi-square tests of significance were used to compare the responses to certain of the questions.

TABLE 18

ANALYSIS GROUPS FOR STUDENT QUESTIONNAIRES,
GRADES 9 AND 10, OTTAWA, SPRING 1983

Group	Number of students		
	Grade 9 Mathematics	Grade 9 Geography	Grade 10 History
Course taken in French:			
Analysis group	103	177	169
Others	30	53	52
Course taken in English:			
Analysis group	308*	317	298
Others	54	81	88

* This group included 51 students who were taking mathematics in English at one school where it was not offered in French, but who had recently taken mathematics in French. Almost all these students were still classified as bilingual program students.

Teacher Questionnaires

Questionnaires were sent to each of the teachers of the grade 9 mathematics and geography and grade 10 history classes being tested. The questions which were asked of all teachers, regardless of the language of instruction, dealt with the general degree of interest of the class towards that subject area and also with the experiences of those students in the class who had previously taken the subject in the other language. The teachers were asked whether any problems resulted from this change in the language of instruction and what measures, if any, were taken to make the transition easier. Another question asked the teachers' opinions of such a switch in the language of instruction.

The teachers of classes taking the subject in French were asked about the degree of French proficiency of the class in general. They were also asked to estimate the proportion of the class which had pre-

viously taken the subject in French and to indicate whether they thought students would have been better prepared to carry on if they had taken it in English. Other questions asked about the advantages or disadvantages they saw in teaching that subject in French and what methods they used to help teach the language as well as the subject area.

Table 19 shows the numbers of teachers and classes in the sample and the number from whom questionnaires were received. In the following sections, when the questions to teachers were the same as those to students, the responses of the former are summarized immediately after those of the students. The balance of teacher responses are discussed in the final paragraph for each subject area. Examples of the questionnaires for students and teachers will be found in the appendix. Modifications were made to make the questions appropriate for each subject and language of instruction.

TABLE 19

GROUPS OF TEACHERS AND CLASSES TAUGHT
REPRESENTED BY TEACHER QUESTIONNAIRES, OTTAWA, SPRING 1983

Subject and grade	Language of instruction	Number of teachers			Classes represented by questionnaire
		In sample	Responding at least once*	Classes taught	
Mathematics 9	French	3	3	6	4
	English	9	9	14	13
Geography 9	French	5	5	11	10
	English	7	7	16	15
History 10	French	6	6	10	8
	English	13	12	16	14

* Although questionnaires were received from this number of teachers, a few were partially unanswered.

Analysis Groups

For the students taking mathematics in English, the questionnaire responses were analyzed for the two basic groups used in reporting the achievement test results. The largest group was composed of 257 regular program students with no recent exposure to mathematics instruction in French. A smaller group included 51 students at one school where grade 9 mathematics was not offered in French; these students had taken the subject in French recently, usually in grades 6 to 8, and most of them were enrolled in the high school bilingual program. These two groups make up the English analysis group shown in Table 18. A third group of 54 students consisted of those whose test results were not included with those of the other two analysis groups. Some of these students had been in an immersion program or had attended a school for francophones, while others had recently spent one or more years at school in another country or were considered by their teachers to have English as their second language.

In the main group of 103 students who had taken grade 9 mathematics in French, nearly all had been in an immersion program in grades 6 to 8 and about half had been in immersion and taking mathematics in French prior to grade 6. No students from francophone schools were included in this group. Another 30 students whose mathematics instruction had been in French included mainly students who had attended a francophone school or whose family was French-speaking, together with a few who had taken mathematics in English in grade 7 or grade 8.

Responses of Students and Teachers

Opportunities to learn French. The responses to a question to those taking the subject in French about opportunities to learn French outside of school are summarized in Table 20. Bilingual exchanges were mentioned most often, especially by those in the main analysis group. When the number, duration and destination of bilingual exchanges were examined in more detail, it was found that all but 8 of the 38 from the analysis group who had participated in such an exchange had done so twice. Fifteen exchange visits of a week or less to Quebec City or Asbestos, 23 of two weeks to Quebec, Sherbrooke, France or Belgium, and 3 of a month to France were reported.

TABLE 20

OPPORTUNITIES TO LEARN FRENCH OUTSIDE SCHOOL,
GRADE 9 STUDENTS TAKING MATHEMATICS IN FRENCH, OTTAWA, SPRING 1983

Type of opportunity	Number of respondents			
	Main analysis group (N=103)	Attended Fr. school (N=22)	Other (N=9)	Total (N=134)
Bilingual exchange	38	1	3	42
Holidays, travel	32	3	1	36
Friends, relatives	10	6	2	18
Camp, summer program	10	2	3	15
At home	3	7	2	12
Jobs or French milieu	5	2	-	7
Other	1	1	1	3

Preparation in mathematics. One question asked the groups taking mathematics in either language how well prepared they felt to carry on in that subject the following year. The responses are summarized in Table 21. The distributions for the bilingual program groups taking

mathematics in either French or English were found to differ significantly from that of the main English analysis group. A smaller proportion of the latter group felt that they were at least "quite well prepared" and more students in this group added comments indicating that they disliked mathematics, found it boring, or were not very good at mathematics. It should be remembered, however, that there were significant differences between these groups in both numerical aptitude scores and mathematics achievement scores, as well as in their class marks.

TABLE 21

OPINIONS ABOUT THEIR MATHEMATICS PREPARATION,
GRADE 9 STUDENTS TAKING MATHEMATICS IN FRENCH OR ENGLISH,
OTTAWA, SPRING 1983

Group	No. in group	Number of respondents			
		Not# well	Ade-quately	Quite well	Extremely well
Mathematics in French					
Main analysis group	99	7	24	42	26
Others	26	3	7	12	4
Mathematics in English					
Main analysis group* (No recent French math)	249	25	92	99	33
Recent exposure to French math	50	4	11	19	16
Others	30	6	3	16	5

This category combines those from "extremely poorly" and "not very well"; the former category was checked by only four students from all groups combined.

* Distribution of responses for this group are significantly different from those for the two bilingual program groups taking mathematics in either French or English ($p < 0.05$).

About 70 per cent of the students in the French instruction analysis group thought themselves either "quite well" or "extremely well" prepared to continue the study of mathematics. The majority of the comments indicated that the students were accustomed to taking mathematics in French and that they did not think the language made a difference. However, three students from the school where students must change to English mathematics after grade 10 made comments like those of the one who said: "I find math easier in French and am scared about going back to English in grade 11." Another respondent, a bilingual program student at the school where grade 9 mathematics was not offered in French, said "I don't think they should give math in English in grade 9, then French in grade 10 and then back to English again." Still another felt that mathematics should be taken in English, commenting that taking the subject in French "does not increase proficiency in that language and will only hinder my understanding of math in English."

When those taking mathematics in French were asked if they thought they would have been better prepared if they had taken it in English, only about 10 per cent answered in the affirmative. A student who felt he was not very well prepared made the observation that "you learn better in French because you have to listen harder". The whole issue appeared irrelevant to another student, who said: "I wish you'd stop worrying about bilingual students being totally warped."

None of the three teachers responding felt that their classes, on average, would have been better prepared to continue if they had taken mathematics in English. Two of them remarked that the course content is identical and one of these said that even the exams are the same as

those taken by the English program group. The last teacher believed that mathematics should be taken in French up to and including grade 10 and then in English in grade 11.

Attitudes towards mathematics. The distributions of the responses of the various groups to a question asking how much they liked mathematics are shown in Table 22. In the group with no recent exposure to mathematics in French the proportion liking mathematics was 46 per cent, while the corresponding proportions in the other two major groups, those with recent exposure to French mathematics who were receiving instruction in English and those in the main analysis group taking mathematics in French, were 68 and 57 per cent respectively. The comparison of the distributions shown in Table 22, using a Chi-square test, indicated that there were significant differences between the small group of bilingual program students at the one school where they had to take mathematics in English and those in the regular English analysis group ($p < 0.05$). Again it should be remembered that there were some differences in the aptitude of these two groups.

TABLE 22

DEGREE TO WHICH GRADE 9 STUDENTS LIKE MATHEMATICS, VARIOUS ANALYSIS GROUPS, OTTAWA, SPRING 1983

Group	No. in group	Number of respondents		
		Like	Neutral	Dislike
Mathematics in French				
Main analysis group	91	52	29	10
Others	26	15	9	1
Mathematics in English				
Main analysis group* (No recent French math)	227	104	93	30
Recent exposure to French math	49	33	12	4
Others	31	20	6	5

* Distribution of responses for this group significantly different from that for the English instruction group with recent exposure to mathematics in French ($p < 0.05$).

Changing the language of instruction. In the total group receiving instruction in French there were 27 who reported that they had, at some time, experienced a change of instruction from English to French or vice versa. Of these, 11 mentioned difficulties and confusion related to the lack of understanding of the terms in the other language. Often this did not last long, but one student said, "I couldn't understand a thing in the first part of grade 6 but later adapted." Nine students from the school at which mathematics was not offered in French in grade 11 expressed misgivings about having to change to English language instruction at that level.

In the group of 257 students receiving mathematics instruction in English, there were 25 students who had experienced a change in the

language of instruction in this subject. Nine of the students reported that this had caused difficulty for them, sometimes related to the need to learn new terms. One student said this difficulty lasted only a few days, while another felt it had been a big problem, especially since there was no possibility of associating these new terms with the French ones. Another had taken mathematics in French in a Montessori school for four years and found difficulty with the change in the methods and thought processes used. The student who said, "I don't understand most things that the teacher takes for granted that I know" may have voiced a frustration also felt by others.

In the group of 51 students taking mathematics in English at one school after previously taking it in French in grades 7 and 8, there were 27 who said they had experienced some difficulties with English terms, particularly early in the year. One of these said, "I hadn't been in English math since grade 5 and it was strange learning all the terms and names in French and then having to learn them again in English."

When teachers were asked about problems related to the change of the language of instruction, about the same proportion of the teachers in the two languages had observed problems with respect to the change. One of the French mathematics teachers who had not observed difficulty commented that students understand the explanations because the number of specific terms is limited and these are defined at the beginning of each section. Another said that sometimes the questions of such students are unclear and the sentence structure used was poor. The comments of some students suggest that the teachers may not always be

aware of the students' problems with specific mathematical vocabulary in the language being used.

One of the English mathematics teachers mentioned students who had switched to English instruction at grade 11 and who were confused and unfamiliar with the English terms. Another said:

> Math is not an easy subject and to switch language half way through high school frequently disorients students. The better students gradually overcome this but many have difficulty. Why complicate a difficult subject?

Another felt that students who have studied in French for eight years have difficulty in adjusting to English for three or four months only and that understanding and patience would help in dealing with such students. Others mentioned the need for individual assistance to students who were making this change, with particular emphasis for those who did not know the English technical terms. Two of the English mathematics teachers felt that a change in the language of instruction could have some benefits, but one said that much depends on the teachers and that ability of the students is also important. Two others felt that such changes should be avoided.

Advantages of taking mathematics in French. Well over half (68 of 103) of the students in the main French mathematics analysis group cited one or more advantages of taking this subject in French. These included improvement of fluency and vocabulary by increased opportunity to use the language, as well as the opportunity to learn the French terms in mathematics. Teachers expressed similar opinions, one saying that since mathematics is a very structured subject it helps the students to structure their minds and to use accurate French to express themselves.

Disadvantages of taking mathematics in French. Almost half of the respondents who had taken mathematics in French mentioned at least one disadvantage in doing so. Most of these pertained to difficulty in talking about the subject in English because of lack of knowledge of the appropriate terms. Two students commented that they could not get help at home from their parents, who were not proficient in French. Three others said they felt that they could not learn as well in French because of their difficulty in understanding the language or in expressing themselves in it. It has already been mentioned that several of these grade 9 students were concerned about the prospect of changing to English instruction at the grade 11 level in their school. The only disadvantage noted by the three teachers of mathematics in French was that there is not enough linguistic content in mathematics.

Subjects that should be taught in French. In addition to français and littérature, the students most often listed mathematics and geography as subjects which were suited to being taught in French. Since these were the subjects actually available and taken by the students at the grade 9 level in most schools, it appears that many probably responded on the basis of their own experience rather than from the point of view of linguistic benefit. Another social science subject was also frequently mentioned, with history the most popular, and almost 10 per cent mentioned a science. One of the four who suggested drama gave as the reason: "I'd like to be able to express myself better in French. I can read and write okay but talking is a different story." Five others spoke of physical education, one saying that "it would be an easy French credit." Among subjects which a few students believed should

not be taught in French were science, geography and physical education.

When asked the same question, only two of the teachers made specific comments. One mentioned that geography, history and science would be suitable because of their greater linguistic content. The other favoured mathematics because it develops the ability to understand French.

Additional Responses from Teachers

Some of the questions addressed to French mathematics teachers related to the French proficiency of their classes. Two of the teachers felt that their students could perform adequately in listening, reading and writing French, and the third teacher felt that the students could be classified as competent in these three language areas, while in speaking all of the teachers considered the students' skills should be called adequate. In two of the classes from 60 to 79 per cent of the students were thought to have sufficient proficiency in French to cope with taking mathematics in that language, while the proportion in the other two classes was felt to be between 80 and 100 per cent.

Analysis Groups

For each language of instuction in grade 9 geography, the student questionnaires were examined for the main analysis group and also for that group of students whose results were not included in the analysis. The first several questions yielded information about the backgrounds of the students required to sort them into the appropriate analysis groups.

Only about 10 per cent of the 317 students in the major English instruction analysis group for geography had some early experience of an immersion or bilingual program or of a francophone school. The majority of the English instruction students not included with this analysis group, however, had recently been in an immersion or bilingual program or in a francophone school, or had taken geography in French. About 60 per cent of the 177 students in the main French instruction group had been in primary-entry immersion at least since grade 4 and another 33 per cent had taken late-entry immersion. Most of the remaining students in geography classes taught in French had either attended a francophone school or spoke French in the home.

Responses of Students and Teachers

Opportunities to learn French. Responses to the question which asked about opportunities outside school to learn French are summarized in Table 23. The order of frequency of mention was similar to that for the respondents to the mathematics questionnaire; bilingual exchanges, mentioned by 40 per cent of the group, were most frequently cited.

TABLE 23

OPPORTUNITIES TO LEARN FRENCH OUTSIDE SCHOOL,
GRADE 9 STUDENTS TAKING GEOGRAPHY IN FRENCH, OTTAWA, SPRING 1983

Type of opportunity	Number of respondents			
	Main analysis group (N=177)	Attended Fr. school (N=38)	Other (N=15)	Total (N=230)
Bilingual exchange	59	5	5	69
Holidays, travel	37	1	2	40
Friends, relatives	18	9	2	29
At home	6	9	9	24
Camp/summer program	17	2	-	19
Jobs or French milieu	8	6	-	14
Other	3	2	1	6

Preparation in geography. A summary of the distributions of responses of the four groups to the question about how well the students thought themselves prepared to carry on in geography is presented in Table 24. The distributions for the main analysis groups taking geography either in French or in English did not differ significantly. About 80 per cent of the total group of students believed themselves to be at least 'adequately' prepared.

For French, the instruction group of 'others' did not differ significantly from the analysis group. However, for English instruction this 'other' group did differ from the analysis group in that greater proportions checked more extreme categories and fewer just 'adequately'.

TABLE 24

OPINIONS ABOUT THEIR GEOGRAPHY PREPARATION,
GRADE 9 STUDENTS TAKING GEOGRAPHY IN FRENCH OR ENGLISH,
OTTAWA, SPRING 1983

Group	No. in group	Number of respondents			
		Not well#	Ade-quately	Quite well	Extremely well
Geography in French					
Main analysis group	163	12	62	70	19
Others	52	5	15	22	7
Geography in English					
Main analysis group*	286	21	119	121	25
Other	70	8	18	32	12

\# This category combines the 11 from all groups who checked 'extremely poorly' and those who checked 'not very well'.

* Distribution of responses for this group significantly different from that for the other group taking geography in English ($p < 0.05$).

Some students in the various groups added comments to explain their responses, a number of them remarking that they would not be taking the subject the following year. Negative thoughts about either the subject or their degree of effort in it were sometimes expressed. However, another student expressed the view of several: "Anyone can do well in this subject if they take all the notes and just take time to study for the tests and learn to memorize." Several students in one school objected to what they believed was excessive note-taking: "There are too many notes to take and not enough of the teacher asking us questions." A few others made specific comments about such matters as the need for more map-reading or for more detailed explanations by the teacher.

In some cases, students had conflicting views. For example, one thought some topics were examined in too great detail, while the comment of another indicated a preference for a more in-depth study rather than just an overview. The opinion of a third was that the course was "very educational because it dealt with more topics than just what city is where. It showed us how our country functions and the problems that arise within industry, etc. In general, it gives a deeper understanding of our country." On the other hand one student did not really enjoy it because he did not feel he was learning much about Canada.

Only a couple of the French geography students referred to the language of instruction as a negative factor, but several others did say that they felt this was not an issue or that they were accustomed to taking it in French. One student recommended the use of more visual material. It became obvious that not only did students themselves differ, but that teachers also varied in their presentations, techniques and in the content taught.

Slightly more than a quarter of the French instruction analysis group believed they would have been better prepared if they had taken geography in English. A much smaller proportion of those not included in the French instruction analysis group responded affirmatively to the question on their preparation; the majority of these students had attended a francophone school and/or had French-speaking parents and many of these said they preferred to take geography in French since they were more comfortable in that language.

Most of those who attempted to explain why they would have been better prepared if they had taken geography in English said they had difficulty comprehending the French or specifically with vocabulary.

One student complained that the teacher spoke much too fast and another pointed out that English-speaking parents had difficulty in giving help at home.

A number of students felt it did not matter which was the language of instruction in geography and some believed that it might be harder in English. One student mentioned several factors: "How well you do in class depends on how intelligent you are, how much you study and how good your teacher is much more than on the language your test is in." Another who claimed to be a somewhat poor student said that he preferred to take it in French because "I learn better in French. I have to listen closely to understand."

The five teachers were agreed that, with one or two exceptions, the students would not be more prepared to continue in geography if they had taken it in English that year. Two of them commented that exactly the same things were taught and one of these said that even the text book was the same.

Attitudes towards geography. The distributions of the responses of the various groups to the question which asked how well the students liked geography are shown in Table 25. More than half the French instruction analysis group 'neither particularly liked nor disliked' geography and another 21 per cent were fairly evenly divided between disliking it either 'very much' or 'somewhat'. The distributions for these two analysis groups were found to be significantly different ($p < 0.001$). When the teachers were asked the degree to which their classes, in general, liked geography, at least 80 per cent of the French and English instruction classes were said to be interested and the balance indifferent.

TABLE 25

DEGREE TO WHICH GRADE 9 STUDENTS LIKE GEOGRAPHY, VARIOUS ANALYSIS GROUPS, OTTAWA, SPRING 1983

Group	No. in group	Number of respondents		
		Like	Neutral	Dislike
Geography in French				
Main analysis group*	167	39	93	35
Others	43	14	19	10
Geography in English				
Main analysis group	295	111	154	30
Others	75	35	35	5

* Distribution of responses for this group significantly different from that for the main English instruction analysis group ($p < 0.001$).

Changing the language of instruction. About 15 per cent of groups taking geography in French reported having experienced a change in the language of instruction. Almost half of those from the French instruction analysis group who had done so reported at least some minor difficulties related to this change; these usually related to a lack of knowledge of the terms and vocabulary needed. It was not surprising that fewer of those from the non-analysis group reported problems since many of them were likely very competent in both languages. One student commented on a change in the teacher's approach: "Other teachers only taught geography. The new teachers were also language teachers - not specialized."

Not included in the main English geography analysis group were 45 former immersion students, almost all of whom had previously had French as the language of instruction for geography. Eight found taking geo-

graphy in English easier than in French and seven commented specifically about some difficulty with terminology or vocabulary when the language of instruction was changed. Two students who had been in a late-entry immersion program felt that they had not learned much geography in grades 6 to 8 and two others felt that the content taught in French had not always been the same as that covered in the parallel English classes. Six of the ten students from francophone schools reported at least minor problems with terminology, one of them adding that techniques were also somewhat different.

The five teachers of geography in French were also surveyed on this topic. Two felt that there were difficulties related to a change in the language of instruction, one saying that such students tended to translate for a short time, but that they made the transition quite easily. To alleviate this, care was taken to provide good definitions of new words and sometimes to use slides for visual input. Another teacher found that these students often need prompting to express the correct terms and vocabulary and that the use of glossaries and having students write definitions of terms in French helped to make this transition easier.

Only one of the seven teaching in English mentioned problems and spoke of the occurrence of French words and spelling errors in written work. Two of these teachers believed that the few students received from the bilingual program for geography seemed to have learning difficulties both in English and in French. One who felt that the change in language of instruction might have some benefits said that some of the vocabulary had a French derivation and that the previous experiences of students who had taken geography in French had sometimes enriched a lesson.

Advantages of taking geography in French. The majority of the French geography students made positive remarks about the advantages of taking geography in French, usually about general improvement of their vocabulary and fluency. Several of these students mentioned specifically class discussions and the suitability of the subject for developing oral proficiency. Another said, "Geography is mostly memorizing, so the more you have to learn and memorize, the better your memory will become in French."

Bilingualism as an asset for future jobs was mentioned by a number of students, one of whom remarked, "It will help in jobs later because I will know more French, know more than just how to write it." Another explained that, "You learn to communicate in French - not only grammar and spelling like you do in français and littérature classes." About ten per cent saw no advantage to taking geography in French. One of these commented, "I'd really like to speak French better but I find this course not much of a help" and another said, "How many times do I talk geography in French besides to my teacher?"

Several of the teachers of geography in French felt that it provided an opportunity to use French in discussion and hence to increase vocabulary. One of the teachers allotted 10 per cent of the marks for spelling, grammar and style, and another spoke of the possibility of building facility of expression in written and oral skills. Another mentioned the viewing of films in French as a means of increasing aural competence.

Disadvantages of taking geography in French. Although about a quarter of the students taking geography in French said they saw no disadvantages in taking geography in French and others made no comment to this question, a number of students mentioned at least one disadvantage. The majority of these students, about 30 per cent of the whole group, spoke of difficulty in talking about geography in English or the fact that they did not know the terms in English. Difficulty in understanding or expressing oneself in French was mentioned by about a fifth of the students. Among the comments made were these:

> "Sometimes I don't understand what the teacher is saying because I don't understand the word. But I don't like to stop her and ask for an explanation because I feel I'm the only one that doesn't know and I'm holding up the class."
>
> "We often don't understand what we are doing, but we are forced to memorize the facts."
>
> "You're supposed to learn geography! If you are in a geography class learning how to speak French it is quite hard to learn two things at once."
>
> "It is often difficult to express your feelings because you can't find the words."
>
> "I fail all the tests. I don't understand what the teacher is saying, and it's extremely and utterly boring."

Three of the students felt they were at a disadvantage because of lower marks than those of students in the English program. One explained, "The bilingual people in French seem to have to work a lot harder than the English people to get the same marks."

Generally the teachers saw more advantages than disadvantages to taking geography in French. However, one teacher reported that class progress was sometimes slowed due to the introduction of new vocabulary and also that students have some difficulty in expression, especially in writing.

Suggested improvements. Fewer than a fifth of the students gave any suggestions for improving the teaching of geography in French either with respect to French or to geography. Field trips or excursions were suggested by nine students, while student projects and visual materials were mentioned by five students. Increased class discussion was mentioned several times; one student felt that "if we could talk more in French (answering the teacher's questions) we could improve our French, and also show how much geography we really do know to the teacher."

The textbook or the teacher were occasionally criticized as being too difficult to understand or for not being interesting, and some made suggestions about different curriculum content. Six of the students either wanted the technical terms and place names given in both languages or felt that there should be more help for terms not understood in French. In contrast, four of the students commented that they thought that the present teaching strategies could not be improved and one said that the teaching in their class was particularly good.

When the teachers were asked the same question some thought there was a need to develop special programs especially adapted to this kind of instruction, differing from those either in English or in francophone schools. In addition to more materials in French like films, exercise booklets, etc., such as are available in English, the need for a better organized geography text in a simpler style was mentioned. It was felt that the present one is difficult even for the francophone students.

The teachers all mentioned various different ways through which they tried to foster the development of the language. This often in-

volved ways of introducing new vocabulary and emphasis on careful correction of usage both in writing and speaking. One teacher mentioned deducting marks for grammar errors and another talked of checking all homework. Discussions were cited as a good way to concentrate on language learning as well as geography, as were films followed by questions.

Subjects that should be taught in French. Students taking geography in French were asked their opinion of the subjects most suited to being taught in French. In many cases the subjects selected were those they were accustomed to taking in French; this was particularly true of those not included in the analysis group, many of whom had attended French schools. Mathematics, selected by about 30 per cent of the students, was mentioned more often than any other subject. Comments such as "mathematical figures are common in both languages" and "numbers are easier to understand" indicated that the lower verbal content of this subject led students to believe it might not be as hard to take in the second language as would be another subject. A number of them suggested that mathematics should be the only subject, other than français and littérature, to be given in French.

The social science subjects were almost as popular; geography and history were chosen by many, although economics and law were also mentioned. The students felt that these subjects would extend vocabulary and fluency, and several thought the implications of having taken history in French might not be as serious as in other subjects. One comment of this nature was that "(History) is not a scientific subject, therefore it is not vital to have it taught in English."

A science subject was mentioned as suitable to be taught in French by about 10 per cent of the pupils and one of the fine arts subjects by several. One of those who chose drama felt it was important "to learn to express myself better rather than just learn to read and write". One of the four who wanted home economics in French felt that "it is a good discussion place to practice oral". A student who had chosen physical education, art and home economics reasoned, "They are easy subjects. This way you can do a lot of speaking in French. If you take geography in French it's mostly the teacher speaking the language because she's explaining."

The status quo was acceptable for eight students and another 25 did not want any subjects, other than français and littérature, offered in French. Two others stipulated that mathematics, science and physical education should never be taught in French. On the other hand, there were four students who suggested giving all subjects in French.

When the teachers of geography in French were asked the same question one said that all subjects were suited since in each case French was used in a new context. One teacher said that the social sciences were particularly good for language development, while another extended this to dramatic arts and sociology.

Additional Responses from Teachers

The teachers were asked to indicate how well their classes performed, in general, in each of the four French language skills of listening, speaking, reading and writing. Several of the teachers noted the great range of proficiency within any one class but, in general, the teachers indicated that proficiency was best in listening, followed

by speaking, reading and writing in that order. In all of the skills except writing, at least five teachers reported that their class performed competently and none said that the students as a group had considerable difficulty. In writing, however, nine of ten classes were said to perform adequately and no class was classified as competent. The teachers of two of the classs commented that these classes still had not mastered writing in French.

The teachers believed that in nine of the ten classes, 80 per cent or more of the students could cope adequately in geography with the French proficiency they possessed. One remarked that those who could not cope had probably already left or would soon be leaving the bilingual program.

STUDENT AND TEACHER QUESTIONNAIRES: HISTORY (GRADE 10)

Analysis Groups

For both English and French instruction groups in history the questionnaires were examined separately for the main analysis groups and for the students whose results were not included in those groups. Almost all of the 298 students in the English instruction analysis group claimed to have been in a regular English program since at least grade 4. Only 16 of this group had experienced immersion since that grade level.

There were 88 additional students, taking history in English, who were not included in the main analysis group. Almost two thirds of these had recently been in an immersion program and most of the balance had attended a francophone school. A few had recently been educated outside of Canada and had not been exposed to Canadian history.

The French instruction analysis group was composed of 169 former immersion students, about two thirds of whom had been in primary-entry immersion and most of the rest in late-entry immersion. Almost all of the 52 students taking history in French who were not included in the French instruction analysis group had attended a school for francophones or came from a French-speaking family.

Responses of Students and Teachers

Opportunities to learn French. The results of the question which asked French instruction groups about opportunities outside school to learn French are given in Table 26. Most frequently mentioned by the analysis group were bilingual exchanges participated in by over a

quarter of the group. As was done for the grade 9 students tested, a further breakdown was made of the duration and destination of the bilingual exchanges participated in by these grade 10 students of whom six reported participation in more than one exchange. Although not all students gave information about duration and destination, 18 exchanges of a week or less and 14 of two weeks to cities in the province of Quebec, as well as five of two weeks or more to France were mentioned. Those not included in the main analysis group were more likely to speak of opportunities to use French at school, in the family, and with friends or neighbours.

TABLE 26

OPPORTUNITIES TO LEARN FRENCH OUTSIDE SCHOOL,
GRADE 10 STUDENTS TAKING HISTORY IN FRENCH, OTTAWA, SPRING 1983

Type of opportunity	Number of respondents			
	Main analysis group (N=169)	Attended Fr. school (N=43)	Other (N=9)	Total (N=221)
Bilingual exchange	46	2	1	49
Holidays, travel	36	7	2	45
Friends, relatives	17	8	3	28
Job or French milieu	12	12	1	25
Camp/summer program	19	4	1	24
At home	7	10	4	21
Other	2	2	0	4

Preparation in history. Responses to the question which asked how well prepared students in various groups felt they were to carry on in history are summarized in Table 27. The only significant difference in the distributions of responses occurred in the English instruction groups. Fewer of those in the main analysis group were 'not very well'

prepared and more were 'adequately' prepared than those in the 'others' category ($p < 0.05$).

TABLE 27

OPINIONS ABOUT THEIR HISTORY PREPARATION,
GRADE 10 STUDENTS TAKING HISTORY IN FRENCH OR ENGLISH,
OTTAWA, SPRING 1983

Group	No. in group	Number of respondents: Extremely poorly	Not well	Ade-quately	Quite well	Extremely well
History in French:						
Main analysis group	161	6	14	57	65	19
Others	51	4	5	15	22	6
History in English:						
Main analysis group*	260	15	20	93	104	28
Others	81	5	17	20	29	10

* Distribution of responses for this group significantly different from that for the other English instructional group ($p < 0.05$).

It was noted by several students that since their next course would be ancient history which had little to do with the grade 10 history course, preparedness in the earlier course need not be a prerequisite. A number of other students remarked that they would not be taking history the following year, and one of these felt that more could be learned from "listening to the news, reading the newspapers, etc."

One of the major complaints was that the students had always taken Canadian history and were consequently bored by it and lacked a knowledge of world history. Other comments related to the quantity of memorization of dates, names and facts, the disruptive presence of some

individuals who are taking this course only because it is compulsory, and the need of a single good text book. One student expressed the thoughtful view that "History is an interesting topic which is essential to our education. However, I feel more emphasis should be put on evaluating the events in history, trying to learn from them and to show the tragedy, horrors of war, etc. than emphasize dates and names."

Although most comments were unrelated to the language of instruction, some students did express specific opinions about marking procedures in the French instructional classes. Three mentioned the disadvantage of having marks deducted on tests and assignments for errors in French grammar and spelling. One planned to take history again the following year but said that "it will be in English so I will not lose 10 per cent for grammar mistakes on every test." Six of the seven students who felt they were just as prepared as they would have been had they taken the course in English but that their marks were lower because of being penalized for grammar and spelling errors came from the same class. In answer to a later question, nine of the 15 students who felt their marks were lower than they would have been in English due to loss of marks for grammatical or spelling errors were from that same class.

Twenty-two per cent of the analysis group and 15 per cent of the others in the French instruction classes believed they would be better prepared if they had taken history in English, although some of these indicated that they would still choose to take it in French in order to improve their facility in the language. One student said, "History would be a bit easier in English but that defeats the purpose of learning French." One student evidently found this comparison quite unnec-

essary and said, "Why worry? Bilingual students are just as competent (if not more) than English students!" About a third of the respondents to this question commented that it did not matter which language the course was given in, or that they were accustomed to taking history in French or even that it was easier for them in French. A couple of students remarked that it is the subject matter or the teacher that makes the difference and not the language.

The difference in emphasis between some French and English classes was mentioned by several students, one of whom said "We learn a lot in French and sometimes a little more from hearing the Quebec side of the story." Another reported that "The only difference is when doing Franco-English relations. We are presented with a very different side of the story allowing us to view the problem objectively." One student expressed the concern that "there is less time for teaching all those topics since not all immersion/bilingual program students speak French fluently."

When the teachers of the classes taking history in French were asked whether their classes, in general, would be better prepared to carry on in history if they had taken it in English in grade 10, none of the six felt they would have been. One of them said that the same skills are taught in the French and English classes and that three quarters of the questions on tests and exams are actually translated from the English versions. Another was of the belief that "the language acts as a stimulant. The idea of what is taught is usually well assimilated. Expression becomes a challenge."

Attitudes towards history. The distributions of the responses of the various groups to the question which asked about the degree to

which the students liked history are presented in Table 28. Although the proportion of the French instruction analysis group which was indifferent to the subject was similar to that in the English instruction analysis group, a significantly smaller proportion of those taking it in French professed to like it and a larger proportion disliked it ($p < 0.05$).

TABLE 28

DEGREE TO WHICH GRADE 10 STUDENTS LIKE HISTORY, VARIOUS ANALYSIS GROUPS, OTTAWA, SPRING 1983

Group	No. in group	Number of respondents		
		Like	Neutral	Dislike
History in French:				
Main analysis group*	154	56	64	34
Others	51	19	21	11
History in English:				
Main analysis group	277	128	114	35
Others	82	37	35	10

* Distribution of responses for this group significantly different from that for English instruction analysis group ($p < 0.05$).

When the teachers were also asked to indicate the degree of interest, in general, of each of their classes, four of those teaching in French believed their classes to be quite interested; the remaining teacher found his classes somewhat disinterested and observed that history is a compulsory subject at grade 10. Half of the English instruction classes were said to be quiite interested and the rest neither particularly interested nor disinterested.

Changing the language of instruction. Slightly more than 10 per cent of the French instruction students reported a change in the language of instruction in history. Only about a quarter of these said the change had caused any difficulties and for several this was apparently a short-lived problem with vocabulary. Another, however, commented that "when you don't understand the language very well, the marks indicate poorness in the subject, not the misunderstanding you are experiencing." Other students, who reported no difficulties, commented that at the earlier grade levels the course content was not likely to cause problems.

History had been taken in French at some time by only 13 students in the English instruction analysis group and only three of these made comments about confusion or difficulty with the French. One of the students remarked that "when I switched to English it was not necessarily because I was not doing well in history, I just thought that my marks would improve if I switched." One student who had previously attended a francophone school also noted a "prodigious change" in the emphasis away from the French aspects of history towards the English ones.

In the group of former immersion students four students felt that in the French history classes there was a greater emphasis on Quebec and the French-Canadian point of view. One of these felt that by taking history in both languages and exposure to both points of view it became easier to understand English-French relations. Most of these students did not find it difficult to adjust to history instruction in English, although four did speak of difficulties adjusting to terms and vocabulary in English after having no problems in French. One of the

five students who did find it was easier once they had switched to English explained, "I could answer questions in a clearer and more comprehensible way in English, whereas in French I had a difficult time formulating good answers," and another "switched because I found it hard enough to just learn the history without having to understand the French as well." Another student found "history in French was much harder but at the same time somewhat more interesting and challenging than history in English."

The teachers were asked if they had had students in their classes who had experienced such a switch in the language of instruction, and, if so, if they had noted any difficulties related to the switch. Three of the teachers of history in English said they were not aware of having any such transfer students in their classes and eight others had not observed difficulties related to the change in the language of instruction. The only teacher who said he had observed difficulties remarked that "spelling seems to be influenced by French immersion". One of the two who believed such a change should be avoided if at all convenient thought "terminology and concepts are better understood if taught in the mother tongue."

Among the teachers of history in French, one had found it especially important to insist on accuracy and on correction of grammar and spelling errors. Another spoke of weaknesses in both written and oral expression. This teacher found it helped to reduce the number of items on tests and to allow more time for them. He also found it necessary to teach some grammar and also to explain how historical vocabulary is used in sentences.

Advantages of taking history in French. The advantages seen by the students in taking history in French usually related to the betterment of French proficiency through increased exposure to the language. This advantage was mentioned by about 60 per cent of the students, a number of whom specified methods used by their teachers to develop skills in oral and written French. Some students mentioned the advantage for future jobs and others that they were working towards the bilingual certificate awarded by the Ottawa Board of Education.

An understanding of the culture and history of French Canada was mentioned by four students, and another 15 expanded this idea to express as an advantage the ability to relate objectively to English-French relations in Canada and to events within Quebec from having the French point of view as well as the English one.

A number of advantages were seen by teachers in the teaching of history in French as a means of developing proficiency in that language. By experiencing a subject other than français or littérature the students realize that French is useful in the practical world and therefore the motivation to learn the language is increased. One of the teachers felt that "students have to make the effort to understand and speak - to defend their ideas. Necessity creates interest in vocabulary and correct expression." Another expressed the conviction that it is a good subject through which can be learned the vocabulary "related to many fields since history (more than other subjects) overlaps just about every field of human activity". Another advantage mentioned by one teacher was that the study of history in French might make the students more sensitive to the problems of French-speaking Canadians.

Disadvantages of taking history in French. Although almost a third of the students did not cite any disadvantages to taking history in French under their present circumstances, others mentioned at least minor ones. Difficulty understanding or expressing oneself in French was most frequently mentioned by the analysis group (23 per cent), as well as by 15 per cent of those not included in this group. Several students felt that unless a student's French was very good there could be difficulties. Others found they missed "small but important details because of a misunderstanding." One student expressed the view of several others in saying, "I can't express my opinions as well and end up not participating as much." One student found that "the emphasis on French takes away from the lesson" and several others spoke of increased time necessary to think and discuss in French or to understand or read. The only disadvantage noted by teachers was that students lose marks for their written French when it is incorrect.

The difficulty in talking in English about a subject learned in French was mentioned by about 15 per cent of both French instruction groups. Most of these regretted that they did not know the English equivalent of the terms they had learned and could not easily express historical ideas in English, and one found it hard to relate to the newspaper, television news, etc.

Difficulty in getting good French textbooks was mentioned by two students, one of whom found "the French textbooks a bit too full of saintly monks and angelic converted Indians." Two others mentioned use of English texts for World War I and II topics.

Just as some students had found it an advantage to know the French point of view, ten found this bias a disadvantage. Some of them made

specific mention of excessive emphasis on Quebec, a perception of bias in the teacher's point of view, difficulty in resolving conflicting viewpoints, or the student's resulting lack of understanding of the English heritage.

Suggested improvements. Many students gave no suggestions as to how the learning of either French or history could be made more successful. Some of the comments made were language related. The need for various oral presentations requiring students to think in French was mentioned by about seven per cent of the students. However, students advocated that they be helped to carry on in French rather than lapse into English and that teachers should encourage participation by other than "the same four or five people". Several students recommended more written assignments; other suggestions included having some oral as well as written tests, the use of plays and skits, and the presentation of new vocabulary prior to the teaching, as well as more use of French in a practical setting (exchanges). Other language oriented ideas were "to make it a truly bilingual course with names of important events and things given in both French and English."

Other recommendations seemed to be unrelated to language. Most frequently mentioned were pleas to make the course more interesting. Among the specific ideas suggested were films or visual presentations, field trips, and a greater emphasis on current affairs. One student echoed the responses given in other questions: "More effort could be made to teach broader aspects of history, since basically all that has been taught since grade 7 is Canadian history over and over again!!!"

Another student said "I feel a deterrent in learning French is the pessimism of the negative students towards the subject and the language. I believe this negativeness discourages the teacher and dampens the spirit of the rest of the students."

When teachers were asked about the methods they used to help students learn French as well as history, all the comments given pertained to vocabulary development and correct expression. They pointed out that grammar and spelling errors were corrected and that discussion, note-taking, library research, and various types of reports were all means of developing a greater proficiency in the language.

Subjects that should be taught in French. When asked which subjects they thought were best suited to being taught in French, 30 of the main analysis group did not wish to take any subjects in French other than français and littérature. Two of these gave as a reason the lower marks obtained in French due to being penalized for errors in the language. Another reasoned that "History, math, etc. are all things that will be talked about in English in the work place later on (living in Ontario) so it is important that I learn them in English." Four others felt that math and/or science should definitely be taught in English.

Of the subjects recommended, mathematics was mentioned by about 25 per cent while geography and history were each selected by about 15 per cent of the respondents. Several students at the school where there is no French mathematics in grade 11 would like it taught in French and were concerned they would not be able to cope in English. A couple of students thought having French mathematics and science would be very desirable for a bilingual job.

The 7 per cent who suggested drama all mentioned such things as the need for more time to talk and gain fluency as well as overcoming their fear of speaking spontaneously in French. Several of these who who selected physical education also had the development of the spoken language in mind. Other subjects mentioned by fewer than 10 per cent were science, music, and home economics.

One of the five teachers who responded to this question felt that any subject is suited to being taught in French, since this allows the students to assimilate vocabulary and language of various different areas. Four of the other teachers mentioned geography, three history, and two mathematics as being suitable, while one teacher believed that the vocabulary in science is too difficult for that subject to be taught in French.

Additional Responses from Teachers

Other questions directed to teachers concerned the French proficiency of their classes. The teachers' perceptions, in general, were that proficiency was greatest in listening and reading, somewhat less in speaking and obviously less in writing. Three of the teachers mentioned the weakness in writing skills, one adding that "they lack the patience to go over sentences to check grammar - silly errors result." Another teacher commented that "this course is usually taken by the better students (academic) who have experienced immersion at the elementary level." Difficulties in speaking French were also mentioned by one teacher who said "they find it difficult to use their new historical vocabulary in sentences and also have problems with the gender of nouns and tenses of verbs".

OVERVIEW

Procedures

Tests developed for use in grades 9 and 10 of the Carleton Board of Education were modified somewhat for administration in the spring of 1983 to students in classes being instructed in either English or French in four English-language schools of the Ottawa Board of Education. The subjects involved were mathematics and geography in grade 9 and history in grade 10, all at the advanced level.

The content validity of the tests was assessed by the consultant in the subject matter area in each case, and test results were compared with teachers' marks, as another indication of test validity. Correlations between the French and English versions of the tests, as well as measures of internal consistency, gave an indication of the reliability of the tests. Item analysis data helped to indicate specific areas of difficulty and differences between groups.

In each subject matter area the group being instructed in French had significantly higher mean scores on the available scholastic aptitude measures than the group with instruction in English. The ability measure with the strongest relationship with scores on the test in question was therefore used as a covariate in each case, controlling statistically for differences in ability through an analysis of covariance (ANCOVA). The measures used were the DAT Numerical Ability score for mathematics and the DAT Verbal Reasoning scores for the groups tested in geography and history.

A set of questionnaires administered to students and teachers of the classes tested yielded subjective information or opinions about

certain aspects of the courses, especially as they related to the language of instruction. The questionnaires were similar in content, with suitable variations according to whether the subject had been taught in English or French and whether they were addressed to students or teachers.

Results: Mathematics

After adjustment for ability, the mean scores on the mathematics tests in both languages for the group taking mathematics in French significantly surpassed those of the group instructed in English on the test given in English. The adjusted teacher-assigned class marks for the winter term were also significantly higher for the French instruction group. However, once adjustment had been made for differences in numerical aptitude, the difference between the two groups on the mathematics test given at the beginning of the year was not significant.

An examination of the mathematics item analysis data revealed no significant differences in the difficulties of the French and English versions of the items for the group instructed in French. Although no attempt was made to control for differences in ability between groups in presenting the item analysis data, all of the differences favoured the group instructed in French and reflect the differences in means mentioned above.

Results: Geography

There were no significant differences in the mean scores of the geography test taken in English between the results for the two program groups at the grade 9 level, after adjustment for differences in abil-

ity. However, the French instruction group had a significantly higher mean score on the test taken in English than on the test taken in French. It must be remembered, however, that although the two forms of the geography test had appeared equivalent in difficulty for a large sample of students tested in the previous year, there is no information about their equivalence for the 1983 sample. When the January geography marks assigned by class teachers were examined, there was no significant difference between the two program groups after adjustment of the marks for differences in ability.

When the geography item analysis of the two instructional groups were compared for the test taken in English, fewer than one item in four showed a significant difference between the two groups, and about half of these favoured the group which had been instructed in English. These results were not adjusted for ability and it does not seem that the language of instruction was an issue in the differences observed.

Results: History

On the history test taken in English by grade 10 students, the difference between the groups instructed in different languages was not significant, after adjustment had been made for ability. However, as in the case of grade 9 geography, the mean score of the group instructed in French was significantly higher on the English version of the test than on the French version. In the case of class marks, after adjustment for differences in ability between the two groups, the mean was significantly higher for the English instructional group than that for the group taking history in French.

An examination of item analysis data from the history test showed a number of items with significant differences between the analysis groups. In most cases one or both of the groups taking the test in English had better results than did the French instructional group on the test taken in French. On several items it was possible to detect some vocabulary which might have caused confusion on the French-language version of the test, and there were occasional items which could have reflected differences in teaching emphasis between the two programs. It seems possible that the lower score of the French instruction group on the test taken in French was largely due to vocabulary limitations, since the group had generally been able to answer questions better in English than in French.

Order of Administration

An analysis was carried out on the results of the students who had taken both the English and the French versions of the test in each subject to determine whether the order of administration had made a difference. In neither mathematics nor geography was there a significant difference in either language between the groups who took the test first or after they had already taken it in the other language. In history there was no significant difference between the results of the test taken in English for the group which took it first and the one which took it second. However, on the French version the mean score of the group which had taken it previously in English was significantly higher than that of the group which took it first in French.

Sex Differences

No significant differences between boys and girls were found on the means, adjusted for differences in ability, on either version of the mathematics test or on any of the four ability measures available for this group. On the geography test taken in English the total group of boys obtained significantly higher mean scores than the girls, after adjustment had been made for differences in ability. The adjusted mean for the boys on the history test taken in English was also significantly higher than that for the girls.

Questionnaire Responses

When the students taking a subject in French were asked what opportunities to learn French outside of school they had experienced, more spoke of bilingual exchanges than anything else. From 25 to 40 per cent of each group had participated in at least one such exchange.

The bilingual program groups taking mathematics in either English or French appeared to feel better prepared to continue in that subject than did the regular program group taking it in English. However, there were also significant differences between these groups in both numerical aptitude and fall mathematics achievement scores. In geography and history, on the other hand, the differences between the analysis groups for the two languages were not significant. About 90 per cent of each group felt themselves to be at least adequately prepared in history and geography. Only about a tenth of the French analysis group in mathematics thought they would have been better prepared if they had taken it in English, but for geography and history the proportion who felt this way represented about a quarter of the groups.

In each subject, various proportions of each group reported that they had at some time experienced a change in the language of instruction of that particular subject. From a quarter to a half of these students reported that they had had some difficulties related to the change in language, but in most cases this seemed to be a short-lived problem with new vocabulary.

The advantages in taking a particular subject in French most frequently mentioned by the students related to the improvement of French proficiency through increased exposure to the language. For geography and history the development of oral proficiency was often specified. In both mathematics and geography, the main disadvantage to taking the subject in French was felt to be the difficulty in talking about the subject in English because of lack of knowledge of appropriate terminology, although many also spoke of difficulties with French. The history students tended to emphasize difficulty with the language more than terminology.

When asked which subjects they thought were suited to being taught in French, students appeared to respond on the basis of their own experiences rather than from the point of view of linguistic benefit and mentioned mathematics most frequently. The teachers seemed to favour the social science subjects because of their greater linguistic content.

Effects of Language of Instruction

This preliminary study of subjects taught in French in the early high school grades to students who had been in immersion classes at the elementary level seems to identify certain differences between the sub-

ject matter areas. The test results did not seem to indicate any detrimental effect in mathematics of having taken the subject in French. The students in the French instructional group tended to have higher scores than the group instructed in English, even after adjustment for differences in aptitude. The students taught in French also did equally well on the test, whether it was given in English or in French.

In history and geography the situation was different. There tended to be no difference between the mean scores on the English-language test of the groups instructed in different languages, after adjustment for ability. In addition, the group taught history in French did significantly better on the English test than on the equivalent French version. They also had higher scores on the French-language test when they had taken the English version first. Similar results were obtained in geography, but the comparisons which could be made were limited because the specific content of the tests in the two languages were not the same. It seems likely that reading comprehension in French may have been a limiting factor in the test performance of students of history and geography, who may not have understood some of the expressions used in French-language items well enough to answer them accurately.

Perceptions of Students and Teachers

Most teachers tended to point out the greater value of history and geography as a means of developing facility in the use of the French language. Students, on the other hand, often spoke of mathematics being easier to take in French because of the more limited vocabulary needed. They also mentioned frequently specific difficulty with tech-

nical vocabulary which they had met in one language and not the other. Most teachers appeared to feel that the courses in the two languages were equivalent, but some students seemed to perceive differences in emphasis, particularly in history.

Marking Procedures

In history and geography many teachers appeared to use the practice of deducting marks for errors in French from the total mark awarded on a test or assignment. This procedure was perceived by students as making it inevitable that their marks in these subjects taken in French would be lower than the marks they would have received if they had taken the subject in English. It does not seem to have been common for teachers to use a marking system which distinguishes clearly between marks given for subject-matter knowledge and marks for language usage. The same problem occurs in the teaching of a subject in the student's first language when attempts are made to emphasize "language across the curriculum".

Opportunities to Speak French

Both students and teachers were aware of the limited opportunities to speak French in high school classes in history, geography and mathematics. Both also mentioned the difficulties that many students had in expressing themselves in French, and particularly in communicating their opinions and feelings. The students, more than the teachers, also mentioned their difficulties with specific technical vocabulary, particularly in geography and mathematics, and their feeling of insecurity when they did not know the English terms for concepts learned in French.

Concluding Statement

Although this study of subjects taught in French did not provide evidence that students had major difficulties in learning various subjects in what is for them a second language, it did show that there were some areas which may need more specific attention. For example, perhaps more effort could be made to be sure that students are able to use technical vocabulary in both languages, since so many of them seem to feel that this is a real handicap. Those teachers who teach a subject in French may need to continue through high school to make a strong effort to help students with difficulties in comprehension, both in listening and in reading, and to provide opportunities for oral communication more systematically than is necessary when instruction is given in the first language. Attention could also be given to the development of marking procedures appropriate for the dual purpose of these courses, language development and subject matter knowledge, and perhaps to the provision of more opportunities for language input from a variety of sources - films, visiting speakers, additional sources of reading material, etc. Such changes should add to the already considerable achievements of the bilingual programs in the Ottawa-Carleton area and elsewhere.

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APPENDIX A

List of Working Papers

List of Working Papers

146 Grade 12 Student Survey: Year Two, Ottawa and Carleton, Spring 1982

147 The Ottawa High School Bilingual Program: Views of Two Groups of Graduates

148 Test of French Reading and Language Usage (Test de français), Grades 8 to 12 Bilingual-Program Groups, Ottawa and Carleton, Spring 1982

149 French Writing Test: Grade 10 Bilingual-Program Groups, Ottawa and Carleton, Spring 1982

150 French Speaking Test (Structures), Grades 8 and 10 Bilingual-Program Groups, Ottawa and Carleton, Spring 1982

151 French Interview Test, Grade 12 Ottawa and Carleton, Spring 1982

152 French Listening Comprehension Test, Grades 9 and 11 Bilingual-Program Groups, Ottawa and Carleton, Spring 1982

153 Subjects Taught in French: Grade 9 Advanced Mathematics, Ottawa, 1983

154 Subjects Taught in French: Grade 9 Advanced Geography, Ottawa, 1983

155 Subjects Taught in French: Grade 10 Advanced History, Ottawa, 1983

APPENDIX B

Examples of Questionnaires

SURVEY FOR GRADE 9 STUDENTS TAKING MATHEMATICS IN FRENCH

Please answer the following questions as best you can but if you really cannot remember, write "don't know". If there is insufficient room please ask for another sheet of paper, and indicate your name and the question you are answering. Your responses will be treated confidentially and only group results will be released.

NAME: _____

SCHOOL: _____ Math Teacher: _____

1. List the schools you attended in the following grades, circling YES or NO to indicate whether you were in a bilingual/immersion program rather than regular English program in that year, and circling ENG. or FR. to indicate whether you took Mathematics in English or in French that year.

Grade	School	City	Imm/Bil Program		Math in Eng. or Fr.	
9			YES	NO	ENG.	FR.
8			YES	NO	ENG.	FR.
7			YES	NO	ENG.	FR.
6			YES	NO	ENG.	FR.
5			YES	NO	ENG.	FR.
4			YES	NO	ENG.	FR.

2. Did you ever attend a school for children whose native language is French? YES NO

If so, in what grades? _____ Where? _____

3. Please describe below any opportunities you have had to learn French outside school.

Type of opportunity	Approximate time (year and duration)

4. Circle how well you feel that you are prepared to take mathematics in grade 10.

EXTREMELY POORLY | NOT VERY WELL | ADEQUATELY | QUITE WELL | EXTREMELY WELL

Comments: _____

5. Do you feel you would be better prepared if you had taken mathematics in English? YES NO
Comments: _____

_____

_____

6. Mathmatics is a subject that I:

VERY MUCH DISLIKE	DISLIKE SOMEWHAT	NEITHER PARTICULARLY LIKE NOR DISLIKE	LIKE QUITE A LOT	LIKE VERY MUCH

7. If given your choice, which subjects other than français and littérature would you prefer to take in French? _____

Why? _____

_____

8. What particular advantages do you see in taking mathematics in French in order to better your proficiency in that language? _____

_____

_____

_____

9. What particular disadvantages do you see in taking mathematics in French

_____

_____

_____

10. Do you have any ideas how teaching mathematics in French to bilingual program students could be made more successful with respect to learning either mathematics or French? _____

_____

_____

_____

_____

11. Did you ever switch from taking mathematics in English or French to taking it in the other language? YES NO

If so, please describe any particular problems or experiences you had with respect to this switch. _____

_____

_____

_____

SURVEY FOR TEACHERS OF STUDENTS TAKING GRADE 9 MATHEMATICS IN FRENCH

We would appreciate your cooperation in answering the following questions as best you can. If there is insufficient room for any question, please continue on another sheet of paper, marking clearly the question you are answering. Your responses will be treated confidentially and will be seen only by staff of the Research Centre. Only group results will be released.

TEACHER'S NAME: _____

SCHOOL: _____ CLASS: _____

(WOULD YOU PLEASE FILL OUT ONE OF THESE QUESTIONNAIRES COMPLETELY AND THEN FOR ANY SUCCESSIVE CLASS, COMPLETE ONLY PAGE 1)

1. In the chart below, mark an X to indicate the degree of French proficiency which you feel the majority of your students possess in listening to, reading, writing and speaking French, adding any comments you wish below.

	Has considerable difficulty	Performs adequately	Performs competently
Listening			
Reading			
Writing			
Speaking			

Comments: _____

_____

_____

_____

2. For what proportion of the students in this class is their French proficiency sufficient to cope adequately in your subject area? (Circle one).

0-19% 20-39% 40-59% 60-79% 80-100%

Comments: _____

_____

_____

3. What proportion of the students in your class would you estimate have taken Geography in French within the last 4 or 5 years? (Circle one)

0-19% 20-39% 40-59% 60-79% 80-100%

Comments: _____

_____

_____

_____

4. Do you feel your students would be better prepared to continue in Mathematics in grade 10 if they had taken it in English this year?

YES NO

Comment: _____

_____

_____

_____

_____

5. Please check which of the following best describes the degree of interest of your class, in general, towards Mathematics.

____ Extremely disinterested

____ Somewhat disinterested

____ Neither particularly interested nor disinterested

____ Quite interested

____ Extremely interested

6. What particular advantages and disadvantages do you see in the teaching of Mathematics in French as a means of developing proficiency in that language?

7. Do you have any ideas how the teaching of Mathematics in French to bilingual program students could be made more successful with respect to learning either Mathematics or French?

8. What methods do you use to help the students learn the language as well as the subject?

9. Which subjects, other than français and littérature, do you feel are best suited to being taught in French? _____

_____

Why? _____

_____

_____

10. Undoubtedly you have taught students Mathematics in French in grade 9 after they have taken it in English. Have you observed any particular difficulties or experiences related to this switch in language or instruction?

YES NO

Please explain: _____

_____

_____

_____

What (if any) measures have you found it desirable to take to make this transition easier? _____

_____

_____

_____

_____

11. Please check which of the following best indicates your opinion of changing the language of instruction of Mathematics?

____ To be avoided at all costs

____ To be avoided if at all convenient

____ Is of no great importance

____ May have some benefits

____ Is very desirable

Comments: _____

_____

_____

_____

_____

_____